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DIESEL RAILWAY TRACTION

A Supplement illustrating and describing developments in Diesel Railway Traction is presented with each copy of this week's issue.

The Royal Road

THE Prince of Wales, speaking at the Centenary Banquet of the Great Western Railway on Wednesday, honoured the company with a title that will earn universal approval when he referred to it as "the Royal Road." In our report of the proceedings on page 729, we record the long association between the Great Western Railway and the Royal House by which His Royal Highness justified the description, but there are further reasons which make the adjective appropriate. The Great Western Railway has earned by its care for the interests of the public that respect and confidence which are the rewards of royalty in this country. It has never feared responsibility nor shirked the changes imposed by progress. It cannot have been easy to relinquish so cherished a tradition as that of the seven-foot gauge, but by its almost overnight conversion the Great Western showed that it set the maintenance of uninterrupted national service above the observance of personal inclinations. That is one of the penalties of royalty. Its rewards become evident at rare intervals, such as on the occasions of centenaries. At such times the spontaneous enthusiasm which greets every tribute to the Great Western Railway must compensate for the long periods during which the public appears to be taking its facilities for granted. Now, from a royal guest at its centenary celebrations, the company has received public acknowledgment of a universal respect which will fortify it in the strenuous labours that undoubtedly lie in the hundred years ahead.

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Time Recovery

As reported on page 736 of this issue, Mr. George Mills, Divisional General Manager, Scottish Area, L.N.E.R., made some emphatic observations, in the course of a paper read to the Institute of Transport at Edinburgh, on the importance of punctuality. To see that timekeeping was observed, he said, was the paramount duty of all transport officers, and he showed that to do so was very closely in their own interests by quoting an instance where one train 43 min. behind time eventually caused a total loss of 6 hr. 22 min. spread over ten services, and consequently a widespread dislocation of working. We are led to wonder by how much this total could have been reduced had all enginemen been given standing instructions regarding the recovery of lost time. Ours is almost the only European country with an extensive railway system where this is not done, and we have repeatedly advocated the adoption of a definite policy in this matter which, while encouraging time recovery, would insist upon the rigorous observance of all speed restrictions. How successful such measures have been abroad is demonstrated by the fact that on recent Continental journeys totalling some 5,000 miles we experienced only two late arrivals, which in themselves represented gains on schedule following delays at frontier stations.

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The Week's Traffics

On the whole the returns for the past week of the four group railways are satisfactory and compare with good takes for the corresponding week in 1934, when passenger and merchandise earnings were generally up and coal class traffics on the London & North Eastern and the Southern were good. For the 43 weeks of the current year the gross takings of the four companies amount to £125,007,000, an increase of £949,000, or 0·76 per cent. Passenger train earnings have reached £57,320,000, an improvement of £1,196,000, or 2·13 per cent. Merchandise receipts of the four companies together for the 43rd week show a net decrease of £22,500, the L.M.S.R. increase of £139,000 and the Great Western gain of £72,000 being offset by losses of £75,000 on the L.N.E.R. and of £158,500 on the Southern.

	43rd Week				Year to date	
	Pass., &c.	Goods, &c.	Coal, &c.	Total	Inc. or Dec.	
	£	£	£	£	£	%
L.M.S.R.	+ 5,000	+ 6,000	+ 28,000	+ 39,000	+ 611,000	+ 1·23
L.N.E.R.	+ 5,000	+ 1,000	+ 20,000	+ 26,000	+ 30,000	+ 0·08
G.W.R.	—	+ 14,000	+ 12,000	+ 26,000	+ 147,000	+ 0·70
S.R.	+ 9,000	− 3,500	+ 1,500	+ 7,000	+ 161,000	+ 0·95

On the Great Northern Railway (Ireland) the increase to date is £46,050, and on the Great Southern £118,534.

* * * *

Central Uruguay Railway

Exchange continues to be the bane of the Central Uruguay Railway Company of Monte Video. The report for the year ended June 30, 1935, shows that the company's currency funds remitted to London have produced substantially less sterling, and a further moratorium until at least September 30, 1936, for payment of 50 per cent. of certain liabilities has been approved. As the result of a further test case on March 12 last the currency earnings due by the company to its extension companies are now converted at the "free" rate of exchange. Even so, however, the working agreements with the extension companies are burdensome to the parent company.

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Figures in the accompanying table refer to the combined system of 980 miles:—

	1934–35	1933–34
Passengers	4,178,285	3,722,047
Public goods, tons	833,641	952,909
Average haul (goods and livestock)	135·40 miles	124·65 miles
Train-miles	2,553,093	2,161,554
Operating ratio, per cent.	83·23	70·07
	£	£
Passenger receipts	156,265	209,267
Goods receipts	423,385	615,119
Gross receipts	892,875	1,205,005
Expenditure	743,112	844,308
Net receipts	149,764	360,697

In currency the traffic receipts showed a decrease of only $24,153 net, passenger and livestock revenues being up, and goods and parcels down. Expenses in currency were, however, up by $899,469. Sterling net receipts of the parent company are only £77,802, against £204,856 in 1933-34.

* * * *

Buenos Ayres Great Southern Meeting

Sir Follett Holt's comments to the shareholders of the Buenos Ayres Great Southern Railway at the annual meeting on Wednesday with respect to the treatment of British-owned railways in Argentina were restrained, but sufficiently clear. He dwelt, indeed, on all the burdens now borne by the railways in the shape of exchange policy, increased labour charges, and the delay in regulating the devastating competition between the various means of transport. But he also indicated the bad effect which the persistence in such a policy might have on the Argentine nation as a whole, and he did not expect the present state of affairs would last very long when its far-reaching effects were fully realised. He pointed out that the United Kingdom purchased from Argentina during the last known twelve months produce to the value of £47,000,000, representing more than one-third of the total value of the exports of that country, though the interest earned on the capital invested in British-owned railways there now amounted to only 1·5 per cent. The retention of such a wonderful market and the goodwill of such a valuable customer were, therefore, vital if the economic position of Argentina was to be maintained.

* * * *

State Competition in Argentina

Far from smoothing the present divergence of interests between them, the long and even intimate relationships that have existed between British railways and the Argentine Government emphasise the unfortunate nature of the existing situation. Addressing the shareholders of the Buenos Ayres & Pacific Railway on Tuesday, the Chairman, the Viscount St. Davids, said he remembered sitting down at a table with a former President and having the low-lying areas that the railway should avoid pointed out to him on a map, these areas being known to the President in detail from the fact that as a young man he had campaigned there against wild Indian tribes. Present members of the Argentine Government should reflect upon the results which have followed this early and informal co-operation between home and foreign enterprise. State competition with the Buenos Ayres & Pacific system, as reported on page 734, is today assuming forms for which it is superfluous to seek excuses. Having sold the San Juan-Mendoza line to the Argentine Great Western, the Government now hopes to enjoy the traffic that company developed by building a parallel route condemned as purely competitive by the physical obstacles against its creating traffic of its own.

Indian Electrification Economies

As reported on page 734 of this issue, Sir Ernest Bell referred in his speech at the meeting of the South Indian Railway last Wednesday to the success of the company's electrification in the Madras area. The public had shown its appreciation of the smooth and efficient working by travelling in increased numbers, and the consequently improved receipts had been accompanied by a reduction in train-mileage. Experience has enabled the company to effect considerable economies in the cost of electric current by obtaining a better load balance. The saving amounted to one lakh in two years, made up of Rs. 52,860 in 1933-34, and a further Rs. 46,136 in 1934-35. The gross ton-miles run diminished by 6·7 per cent., and at the same time the figure of kWh. per 1,000 gross ton-miles was reduced by no less than 12·9 per cent. The chairman said that these results were not only a source of satisfaction to the company, but reflected great credit upon the consulting engineers, Messrs. Robert White and Partners, whose advice in solving the various problems presented by the operation of the electric services had always proved invaluable. The increase in passengers in this area at a time when the total number carried has declined is a further tribute to the electrification.

* * * *

Education in the German Railway Service

Dr. Bruno Schwarze contributes an interesting article to *Der Eisenbahnfachmann* on the development of education for the railway service in Germany. At the present time this is being conducted on a well organised plan, the result of many years' experience, and a subsidiary publishing concern associated with the Reichsbahn issues, for the use of the railway schools and colleges, valuable and extensive series of text books and other publications, many of which have been reviewed in our columns in recent years. In his sketch of the question, Dr. Schwarze shows that some form of organised railway training, although of decidedly limited scope, dates back to the days of private ownership, but it was undoubtedly the steady policy of State absorption that gave a real impetus to the institution of an effective educational system for railway work, which assumed established forms in all the German States in the closing years of the last century. The States had their own laws on the subject, however, and a curious case is cited of a native of Württemberg who studied in Munich and passed the State examinations there, only to be told that he could not enter the Bavarian public service. Endeavouring, therefore, to enter that of his own State at Stuttgart, he was informed that qualifications obtained in Munich were not recognised there. Since the Reichsbahn was formed in 1920, a uniform scheme of education covering all grades has been steadily aimed at.

* * * *

Another Occupation Crossing Accident

On page 733 herein is a summary of the report by Colonel Trench of a passenger train on the Great Western Railway South Wales main line, where trains run at speeds up to about 70 m.p.h., colliding with some cattle at an occupation crossing on July 15. In contrast to the usual situation in cases of this kind, the road user was not at fault. He crossed the line at a time when he knew by experience that there was a gap between trains; he looked in each direction, and he opened the farther gate first. He was not, however, aware that, with the summer train service, the train concerned had just begun to run five minutes earlier. Neither did he appreciate that the signal for the up line 180 yd. from the crossing was a distant signal, and that it being in the " on " position

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did not imply that no train was coming. Colonel Trench considers that the railway staff should be encouraged to warn the regular users of such crossings of material alteration of train timing, and that the users should be made to understand the significance of a distant signal. The most important feature in the report is the attention drawn to the fact that if under normal conditions cattle can cause derailment of a locomotive-hauled train, how much greater is the risk in the case of multiple-unit electric trains, the use of which is now extending into country areas where cattle crossings are more frequent than in the suburban areas to which such trains have hitherto been confined. Attention might also be drawn to the potential risk to railcars.

* * * *

Collision at a Railway Grade Crossing

A feature of recent years on the railways of the United States is the automatic protection of railways that cross each other on the level, as occurs in this country at Newark, at Retford, on the L.M.S.R. Bedford-Hitchin branch at Bedford, and at the intersection of the Somerset & Dorset with the Great Western main line at Highbridge. The principle adopted in America has been brought out in the report on a fatal collision in the State of Iowa on June 13 last. In that case stop signals were provided 100 yd. from the fouling point, and distant signals, permanently in the "caution" position, 800 yd. in the rear of the stop signals. The stop signals were approach-lighted as the trains passed the distant—which fact suggests that the distants were permanently illuminated. On the day in question a freight train collided at the crossing with a passenger train, for which the signals were certainly at "clear," and a baggageman was killed. The driver of the goods train claimed that his stop signal went to "clear" when he was at the distant, but in the absence of corroboration, and of defects in the signal equipment, it was fairly conclusive that his signal was against him. Details, corresponding to the English trap point, were not in this case provided. It would be outside our province to make suggestions, but we would point out that at the Liverpool Central (Low Level) station of the Mersey Railway there are two crossover roads and a trap point automatically worked, through track circuits, by trains, and that some points are similarly operated at Barking and Upminster.

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The Station Block in Italy

In many respects the signalling in Italy bears a resemblance to that seen in Great Britain, from which indeed the earliest Italian installations were derived. The semaphore type of signal is used almost everywhere and the bracket pattern is the present standard for junctions. Lock-and-block of the Cardani type, which has some points of similarity with the Midland "rotary," is found on the principal main lines. Electric staff working was applied many years ago on the Lecco-Sondrio electric line, combined with a clever dead section arrangement whereby a train could not get power to start away from a station unless a staff had been taken out there for it. Hydraulic power signalling has been extensively used, but of late years all-electric has superseded it. In one respect Italy has followed Central European signalling ideas and that is in the use of the so-called station block, whereby all the movements in a station area, especially where there is more than one signal box, are brought under the control of a superior official upon whom the final responsibility rests. For this purpose several types of control instrument have been developed, most, if not all, of the direct current pattern. Soon after the war, on the basis of experience gained with them, a new station block apparatus was constructed and it has been described in the *Rivista Tecnica delle Ferrovie Italiane* by Signor G. Pacetti. A very compact design has resulted, as an illustration of an instrument for Arquata Scrivia station shows, as well as another of a modified apparatus for Bologna. This method of working seems peculiar to British ideas, although not unknown in India, but it must be remembered that the station block in some cases allows a good deal of slotting, which would otherwise be essential, to be dispensed with.

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Sleeper Treatment in India

In past years India relied mainly upon a number of very excellent indigenous timbers, such as sal, deodar, Burmese pynkado and even teak for sleepers, timbers which require no treatment. More recently, however, their cost has gone up so much that a large proportion of chir, kail, laurel, eng and other soft woods, available in almost unlimited quantities in the lower Himalayas, Burma or elsewhere, is now used, but these timbers have to be treated. Some 7,000,000 of these soft-wood sleepers have been impregnated with creosote and crude oil by the pressure treatment at the Dhilwan plant on the North Western, and the newer Naherkatiya plant on the Assam Bengal Railway, and their service in the track has secured the steadily increasing confidence of railway engineers. For the past ten or more years this treatment has been standardised, but owing to the high cost of creosote—which in India is more than twice what it is in England—the cheaper compounds of arsenic and copper, also forced into the wood under pressure and used in conjunction with a crude oil treatment to prevent splitting, are now proving their worth. A valuable record of the results obtained with sleepers experimentally so treated and laid in Indian railways between 1911 and 1916, is contained in the Indian Forest Department's Bulletin No. 85, published last year. The bulletin concludes by saying that the possibility of the arsenic and copper treatment superseding creosote in India is a matter that needs very careful consideration.

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South American Articulated Locomotives

Since the article on the new 2-8-0 + 0-8-2 Kitson Meyer locomotives for the National Railways of Colombia was published in our issue of September 13, we have had occasion to refresh our memory of the development of this type of locomotive, and its application to the special conditions which rule in Colombia. One result of our investigations has been to remind us of an intermediate class of Kitson-Meyer engines which, although not referred to in the article, nevertheless played an important part as a link between the early engines of 1909 and the latest and largest design, with two sets of eight-coupled wheels, sent out in the present year. In 1927 the firm of Kitson & Co. built a 2-6-0 + 0-6-2 type, in the design of which Mr. P. C. Dewhurst, the then Chief Mechanical Engineer, was actively concerned. There was a striking likeness between the six-coupled engines and the latest eight-coupled type, although naturally the 1935 engine is a larger and more powerful unit than its predecessor, just as in its turn the locomotive of 1927 marked a considerable advance upon the first engines built in 1909. The 1909 engines developed a tractive effort of 27,600 lb., a figure which in the 1927 design was increased to 40,000 lb., and has now, in the engines designed by Kitson's and built by Robert Stephenson & Co. Ltd. in 1935, grown to 58,500 lb. It will thus be seen that the evolution of this class of locomotive has progressed steadily, thereby demonstrating its suitability for the service conditions to be met.

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Irish Free State Railways in 1934

THE railway returns recently published by the Irish Free State Government for the year 1934 cover the railways wholly in the Free State and those partly in the Free State and partly in Northern Ireland. The only railway operating undertaking lying wholly in the Free State is that of the Great Southern Railways Company, with a route mileage owned of 2,037 miles 73 chains, in addition to 120 miles 20 chains leased or worked, including the Irish lines of the Fishguard & Rosslare Railways & Harbours Company, 104 miles, and certain colliery lines. Total single track owned including sidings was 2,616 miles 31 chains. Route mileage owned in 1933 was 2,048 miles 53 chains and total single track mileage 2,623 miles 33 chains. Difference in route mileage in the two years is accounted for by the removal of the Kinsale branch, and in track mileage by that removal and by the addition of 3½ miles of sidings. For the railways wholly in the Free State the financial tables and certain of the statistical returns follow those given in the Great Southern Railways Company's annual report, but they are supplemented in the Government return by detailed operating statistics. The same procedure is adopted with the Great Northern Railway which has a route mileage of 229 miles 56 chains of 5 ft. 3 in. gauge line in the Free State and 332 miles 35 chains in Northern Ireland, but the data regarding the other railways situate in both territories are grouped together, and the further operating statistics for these railways are not available. They include the County Donegal Joint Railways 90 miles 71 chains, Londonderry & Lough Swilly 82 miles 40 chains; Sligo, Leitrim & Northern Counties 43 miles 21 chains; and Dundalk, Newry & Greenore 26 miles 68 chains. These border railways have 52 miles 59 chains of 5 ft. 3 in. gauge line, and 202 miles 39 chains of 3 ft. gauge line in the Free State.

Gross railway receipts of the Great Southern Company for the year 1934 while exceeding those for 1933 by £161,254 or 5·61 per cent., were less than those secured in 1932 by £7,373. Owing to the prolonged strike of the Great Northern Company's employees during 1933 any comparison with the receipts for that year would be of little value, and in the accompanying table, accordingly, the comparisons are made with 1932:—

	1934			1932		
		Railways partly in Free State			Railways partly in Free State	
	Great Southern Railways	Great Northern	Other Railways	Great Southern Railways	Great Northern	Other Railways
Passenger journeys ..	8,565,000	4,746,795	506,739	8,160,353	5,191,854	485,677
Goods, tons	2,473,637	771,832	159,124	2,115,084	893,802	183,565
Average haul, miles ..	65·76	51·52	—	59·89	51·51	—
Train-miles	9,103,080	3,475,463	679,670	8,684,771	4,097,961	654,607
Operating ratio, per cent.	89·97	96·02	133·84	86·92	94·71	125·99
	£	£	£	£	£	£
Passenger train receipts	1,247,958	520,630	27,697	1,322,485	569,471	32,727
Goods train receipts ..	1,763,219	453,958	59,388	1,697,403	586,044	75,017
Gross railway receipts..	3,033,166	993,302	90,792	3,040,539	1,174,583	114,480
Railway expenditure ..	2,719,846	945,306	118,208	2,635,696	1,106,411	137,180
Railway net receipts ..	313,320	47,996	Dr. 27,416	404,843	68,172	Dr. 22,700

On the Great Southern there was a marked increase in 1934 over 1933 in the total volume of freight traffic, noted in each of the main heads of traffic, except livestock, in which there was a decrease of slightly over 6 per cent. The average wagon load improved from 3·17 tons in 1933 to 3·52 tons in 1934, and the average train load from 52·44 tons to 56·31 tons. The Great Northern average train load improved from 53 tons in 1932 to 66·75 tons in 1934, and the average wagon load from 2·82 tons to 3·02 tons. Passenger journeys (other than by season ticket holders) decreased by 2·2 per cent. on the Great Southern Railways in 1934 in comparison with 1933, and on the Great Northern Railway by 8·6 per cent. in comparison with 1932.

The number of passenger licences granted under the Road Transport Act, 1932, and under which road passenger services were operated during 1934 by railway companies amounted to 801, of which the Great Southern operated 565, the Great Northern 218, and the Londonderry & Lough Swilly 18. These figures represent increases of 114, 44, and 6 respectively over those for 1933. For merchandise road services no licences were transferred in the year under review to railway companies under the compulsory provisions of the Road Transport Act, 1933, and no voluntary transfers were effected. Great Southern road transport net receipts amounted in 1934 to £80,394, an improvement of £65,391 on 1933. The figures are not comparable, however, as the results of working road transport services appear in the accounts for the first time, the businesses of the Irish Omnibus Co. Ltd. and of John Wallis & Sons Ltd., which previously had been controlled by the Great Southern Railways, having been absorbed as from January 1, 1934. The road transport gross receipts for 1934 were £704,778 and the expenditure £624,384, giving the net figure of £80,394. On the Great Northern there was a road transport loss of £8,318 due to special causes.

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Beira and Mashonaland and Rhodesia Railways

A TOTAL length of 2,708 miles on the 3-ft. 6-in. gauge is included in this system, of which 112 miles are in the Cape Province and 197½ are in Moçambique (Portuguese) Territory. Though belonging to four separate companies, namely, the Mashonaland Railway Co. Ltd., the Rhodesia Railways Limited, the Beira Railway Co. Ltd., and the Shabani Railway Co. Ltd., they are worked as to 2,119 miles by one administration, and the 589 miles extending from Vryburg to Bulawayo, including the Matopos branch, are operated by the South African Railways. Bulawayo is the effective centre of the system, from which railways extend to the border of the Belgian Congo on the north, to Bechuanaland on the south, and to the port of Beira on the east.

According to the report for the financial year ended September 30, 1934, which we have received from Mr. H. Chapman, C.B.E., the General Manager, the revival in business which became apparent towards the latter part of the previous financial year was more pronounced in the year under review. That the increase in working expenditure was only 8·6 per cent. when the increase in earnings was 34·6 per cent. was due largely to the continued efforts to ensure the most economical operation consistent with efficiency. The improvement in traffic during the year under review may be attributed primarily to the progressive activity of the copper mines in Northern Rhodesia and to the considerable expansion of the gold mining industry in Southern Rhodesia. Passenger traffic also showed a definite expansion. There was a noticeable increase in tourist traffic to Rhodesia from the Union of South Africa and from overseas during the year.

Revenue from general goods advanced by 41·6 per cent., and there was a record tonnage of copper for export, which brought in £718,370, an increase of 44·3 per cent. on 1932-33. The accompanying table compares some operating figures for the past two financial years:—

	1933–34	1932–33
Passengers, number	624,519	613,188
Total goods, tons	1,894,643	1,480,169
Operating ratio, per cent.	63·66	79·06
Train-miles	4,268,656	3,425,619
	£	£
Passenger receipts	314,953	279,615
Goods and mineral receipts (excluding departmental)	3,299,105	2,343,588
Gross earnings	3,895,490	2,887,677
Gross operating expenses	2,479,748	2,282,968
Net earnings	1,415,742	604,709

In expenditure on way and works the increase of £49,479, or 15·2 per cent., was due principally to the changing of worn rails, replenishment of ballast, heavy maintenance work on bridges, abnormal expenditure on water supplies, partial restoration of the temporary salary and wage deductions, and the increase in working hours. Locomotive running cost £51,361, or 13·6 per cent., more, though engine mileage increased 22·7 per cent., and traffic running expenses were greater by £20,442, or 9·9 per cent., whereas train-mileage increased by 24·6 per cent. Both these heads of expenditure were affected by the partial restoration of the salary and wage deductions. Efficiency in traffic operations in the sections north of Bulawayo has been well maintained as is shown by the progressive growth since 1930 of net ton-miles per train engine hour from 3,038 to 4,386, train-miles per train engine hour from 13·7 to 16·5, and the average net train load from 222 tons to 266 tons.

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The Anti-Rail-Road Journal

OPPOSITION to particular schemes of railway construction in the early days of the industry is recognised as a feature of British industrial history, but we think it is far less well known that a hundred years ago an organisation was in being with the avowed object of opposing *all* railways. This body had headquarters at the London Anti-Rail-Road Office, No. 2, New North Street, Red Lion Square, where its affairs were directed by Mr. R. Cort, who acted as its Secretary. He also officiated as Editor of *The Anti-Rail-Road Journal; or, Rail-Road Impositions Detected,* an interesting production and, of course, of a highly partisan character. Through the courtesy of Mr. Kenneth Brown, President of the Railway Club, we have recently had the opportunity of reading Part IV. This journal appears to have been an occasional paper rather than a regular periodical, and the number in front of us, which was priced at 3s. 6d., bears the prefatory date March 9, 1835, to its 124 pages.

The main themes of this particular issue are replies to articles in the *Edinburgh Review* and in the *Mechanic's Magazine.* These replies are designed not only to expose "plausible but fallacious arguments" in the statements of those important journals, but also to impute dishonest motives to their writers, and especially to Mr. John Clinton Robertson the Editor of the *Mechanic's Magazine.* Obviously such propaganda was not merely of a negative order and it is easy to see that the parties who hoped to benefit were the canal companies, the turnpike trusts, and the promoters of steam carriage companies. Only a year or two earlier the turnpike trusts had been the chief opposers of steam carriages, but the two forces were prepared to unite against the common enemy—the railway. *The Anti-Rail-Road Journal* therefore referred to the "glaring anomaly of British legislation, one day granting Acts of Parliament to incorporate proprietors of £30,000,000 of capital vested in inland navigation, and the next destroying the very security which it had created by sanctioning projects for railways, based on profits grossly misrepresented by the payment of dividends out of borrowed money; and which again will in their turn shortly be superseded by steam conveyance on common roads." These somewhat unpopular vested interests were not considered strong enough cards, however, and strenuous editorial efforts were made to show that the issue was really the protection of the agricultural interest.

The most interesting feature is the statement of objects of the London Anti-Rail-Road Committee. This said that "the extension of the railway system, which under the pretence of keeping up the balance of intercourse, it is advocated should be generally introduced throughout England, will be attended by the following evils:—

First, it will destroy, in a great measure, £30,000,000 of capital now vested in canals, and river navigations.

Second, it will cause the abandonment of the public thoroughfares of the kingdom, and the consequent depreciation of property of every description situated upon it.

Third, it will leave unliquidated £10,000,000 of road debts, and cut off the revenues which now maintain 180,000 miles of turnpikes and highways.

Fourth, it will throw out of cultivation 100,000 acres of land, force many of our most distinguished families to leave their family mansions, and separate, disfigure, and destroy many valuable estates.

Fifth, it will, in effect, by the displacement of brute power, repeal the Corn Laws without making any provision for the protection of the landed interest.

Sixth, it will so divide the trade, as to render the prosperity of anyone of the carrying establishments quite impossible, besides bringing to distress all the numerous parties connected with and dependent upon this class of the community in every town along which such communications are made."

Little short of half a million sterling, it was stated, had been already expended in Parliamentary opposition to railway projects; similar sums, it was added, must be sacrificed by other dissentients on the lines then seeking for legislative sanction, should the proposed Bills find their way into Committee. The objects of the London Anti-Rail-Road Committee were "(a) to concentrate under a recognised establishment in London, all information relative to the railway question with a view by its periodical publication to open the eyes of the nation to the delusion that prevails upon the subject; (b) to organise and give efficiency to the co-operation and opposition of railway dissentients; and (c) to diminish by the united resources of all parties interested, Parliamentary expenses." The list of subscriptions which followed was headed by £37 10s. from the Provost and Fellows of Eton College; this was doubtless because the G.W.R. Bill was then before Parliament. The same reason also explained £5 from the assistant masters at Eton College, £20 from the Kennet & Avon Canal Company, and £21 from the Committee of Land Owners opposed to the G.W.R. Other donations came from various canal companies, steam coach companies, and famous carriers such as J. Baxendale of Pickford & Co., Chaplin & Co., and Horne & Co.—incidentally, all these carriers became associated with railways shortly afterwards. The Anti-Rail-Road statement "confidently anticipated, that, by bringing the leading facts of the railway question fairly before the whole community, first, at a public meeting in London, and secondly by petition to Parliament with a view to obtaining a Committee of Inquiry into the railway system prior to the appointment of any Committee on the various railway Bills, that it would not fail to

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place the whole case in such a light, as to cause, both on private and public grounds, the entire abandonment of the system."

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New Chinese Railways and Locomotives

WE have from time to time had occasion to call attention to what we consider is the remarkable expansion that is taking place in the railway system of China. The extensions of its various component railways during the past twelve months, as briefly outlined upon page 712 of this issue, confirms this opinion, and shows that during the year November-October no fewer than 700 route miles of line have been constructed, or roughly two miles a day. The Tatung-Puchow, a Provincially-owned railway in Shansi, claims the longest new mileage completed in this period, some 290 miles, but though it is of standard gauge, it is built to a very light general standard with only 60-lb. rails. The most important east to west trunk line, the Lung-Hai Railway, has carried its main line 40 miles farther westwards to Sian, or Sianfu—as this, the capital of the Province of Shensi, is a city of "fu" status—and it is still being rapidly extended. Another important new section of line now connects the Federal Capital, Nanking, with Wuhu, and three new railways have been built mainly to serve coalfields, one of which will be over 150 miles in length when completed, and of which about 100 miles are already open. But undoubtedly the most important of the new lines is the Canton-Hankow Railway, a south-to-north trunk line, the construction of the middle 240 miles of which has only recently been undertaken and which is expected to be completed and ready for through operation by this time next year. As may be remembered this construction is being carried out in very difficult country, views of which were illustrated in our issue of March 9, 1934. Its importance lies in the fact that the Canton-Hankow will form the final link in a new trans-continental chain of railways from Canton to Wuchang, on the south bank of the Yangtze opposite Hankow—where there is to be a train ferry—Hankow to Peiping and Harbin, connection there being made with the 5 ft. 0 in. gauge system which extends across the U.S.S.R. to the Baltic.

So rapid a railway expansion throughout China naturally requires the importation of considerable quantities of rolling stock, equipment, stores and other materials not available in the Republic. The British share of these imports, ordered during the past year, has been 24 powerful locomotives (Vulcan Foundry Limited)—described and illustrated elsewhere in this issue—47 coaches (Birmingham Railway Carriage & Wagon Co. Ltd.), 150 wagons—100 covered type (Metropolitan-Cammell Carriage & Wagon Co. Ltd.) and 50 open trucks (Turner & Head Wrightson)—a turntable (Cowans Sheldon), bridging materials (Dorman Long & Co. Ltd.), some £200,000-worth of machine shop equipment, power house plant and large quantities of general requirements. As might be expected, so important a line as the Canton-Hankow, with its heavy gradients and prospective through traffic, is to be apportioned 10 out of the first 16 of these new Vulcan locomotives now being delivered. Though light of axle load, their great length and size will require a high standard of permanent way construction and maintenance, which the experienced supervision of the Consulting Engineers, Messrs. Sandberg, and of the Engineer-in-Chief, Mr. H. H. Ling, will doubtless assure.

In present circumstances so large an order as for 24 locomotives of unusual size and design is of considerable importance to a locomotive building firm in this or any country, and the Vulcan Foundry is to be congratulated upon securing the order for the first 16 of these 4-8-4 type engines in November last, and the remaining 8 in August. Intended for heavy service, they are equipped with 12-wheeled tenders and their overall length is 93 ft. We are now able to illustrate and describe these remarkable engines in some detail, following upon an inspection of them at the builder's works. Apart from their size and the unusual wheel arrangement of both engines and tenders, there are points in their design which class them as something out of the ordinary, and their equipment also incorporates features worthy of special mention. Attention is drawn to these in the article on pages 714-719. The design of the boiler, arrangement of the tubular heating surfaces, staying of the firebox and combustion chamber, smokebox arrangements and the boiler fittings will, we think, provide matters of interest for our readers, and a point to which further attention may be directed is the diameter of the piston valves in relation to that of the cylinders, and the long travel imparted to the valves. Some of the engines will have boosters arranged for driving the leading six-wheeled bogie of the tender, whilst provision is made for applying boosters to the trailing engine bogie should it be desired to do so at a later date. The boiler is mechanically fired and compressed air and electric fittings are used for lighting and control purposes. The unusual length of the locomotive is accounted for in large degree by the necessity of keeping down the weight per foot run and, although in relation to the boiler and other characteristics the cylinder diameter may be regarded as moderate, it must be remembered that the coupled axle loadings are compulsorily light and therefore the balance between cylinder and adhesive power is entirely correct.

LETTERS TO THE EDITOR

(The Editor is not responsible for the opinions of correspondents)

L.M.S.R. Autumn Accelerations

Jodhpur Railway,
Jodhpur, India.
October 9

TO THE EDITOR OF THE RAILWAY GAZETTE

SIR,—I have been reading today with great interest the letter of your correspondent Mr. Newton Brook in your issue of September 6, and, while I agree with him in the main, I cannot quite agree with him that the London to Brighton run is analogous to the Manchester-Blackpool run. On the London-Brighton run the congested area may be said to finish at East Croydon (10¼ miles from London), after which there is a clear run through to Brighton.

Contrast with this, on the Manchester to Blackpool run, a densely congested area to Bolton (10¾ miles), unassisted by any form of electrification, followed by Chorley (22 miles) and then a prolonged slack approaching, and passing through, Preston (30¾ miles), followed by a drastic speed restriction north of that station. The fact, however, remains that in 1911 the Lancashire & Yorkshire Railway was managing the run in 1 hr. 5 min.—a better time than today. I agree with Mr. Brook entirely about the appearance of the rolling stock.

The engines up north today cut a very sad figure, by comparison with the old North Western, Caledonian, and L. & Y. engines of pre-war days. I personally would welcome a change from the rather monotonous L.M.S. "all red" coaches, too. Granted that the old West Coast colour can never be restored, why not the old North Western chocolate below the waist line and the L.M.S. red above? This would be a most attractive combination. I believe, however, that this was tried in 1923 and found too costly.

Yours, &c.,

J. P. BARDSLEY

PUBLICATIONS RECEIVED

The Great Divide. By Alan Sullivan. London: Lovat Dickson & Thompson Limited. 5¼ in. × 8 in. 417 pp. 8s. 6d. net.—Railway novels are not unknown, though they are certainly rarer then they might be. A good railway novel is certainly very rare, yet "The Great Divide" is not only a good railway novel, it is a good historical novel also. As its title indicates, the whole plot revolves round the epic building of the Canadian Pacific Railway, and the story reveals the most intimate details in the lives of Van Horne, Stephen, and Donald Smith, all of them most carefully authenticated. In detail equally intimate, we are given the lives of those who lived and toiled on the advancing steel track, who carried the "All Red Route" through the Rockies and the Selkirks, and through the even more pitiless barrens to the north of Lake Superior. The crisis of both capitalist and labourer is described with the grim strength of a really great novelist. Yet like more than one great Victorian writer, Mr. Sullivan tends to weakness where the feminine element comes in. His women are not entirely real, though the sweet mawkishness of Dickens' "Little Nell," for example, is hardly attained by the angelic, though capable heroine of "The Great Divide. The book is worth reading if only for the wonderful portrayal of the stern and heroic, yet queerly pedantic, figure of Donald Smith, who afterwards became Lord Strathcona, and there is much more in it than that. One can live through the entire struggling early life of the C.P.R.; see all those who were but names before; hear the roar of the Frazer River; and feel the cruelty of the Northern winter.

100 Jahre Deutsche Eisenbahnen. (100 Years of Railways in Germany.)—Special Commemorative Issue of the German State Railway's official journal *Die Reichsbahn*. Berlin, S.42: Otto Elsner Verlag. 11¾ in. × 8 in. 135 pp. Illustrated. Price 8 RM.—This volume is one of several which have been issued this year in Germany in connection with the railway centenary celebrations, and has as sub-title the words "The German State Railway in 1935." The preface is contributed by the Minister of Transport, Freiherr von Eltz-Rübenach, and there are sixteen articles written by experts, each dealing with his own department of railway working, and covering staff affairs, rates and fares, train services, rolling stock, civil engineering, workshops, railway law and public relations, light railways, motor services—on rail and road—and the Nuremberg exhibition. The historical chapter contributed by Dr. Sommer is attractively done, and illustrated with a number of reproductions of old prints, selected from those in the current German State Railway Calendar. The engineering chapters are exceedingly interesting and the photographic illustrations well chosen. The volume contains a very large number of advertisements, which come as a surprise to the reader who, on first picking up the book, thinks he is opening a heavy treatise on railways. Nevertheless the advertisements are themselves interesting and in many cases contain historical information on the development of firms whose names have long been household words in the German railway world, and often far beyond it. The publication is beautifully printed on art paper.

Cahiers des Charges et Specifications Techniques des Grands Reseaux de Chemins de Fer. (Standard Specifications of the French Railways.) New edition, 1935. Paris: Dunod. 6 in. × 4 in. 218 leaflets and booklets in pegamoid portfolio. Fr. 193.—The specifications and standards adopted for the supply of constructional and other materials to the French railways have recently been extensively modified, and the new standards established with the concurrence of the railway administrations and leading industrial concerns are used by the latter for other than railway purposes. The revised collection of specifications now issued thus extends its influence far beyond the railway field. The individual documents range from single-page leaflets relating to various oils and spirits to booklets of various sizes: for example, 46 pages on the classification and specification of timbers; 95 pages of requirements imposed on wagons of various types, as regards construction, dimensions, brakes, and so on; and a special publication of 69 pages giving the series of bolts, studs, nuts, washers, pins, screws, and rivets standardised by the Comité Supérieur de Normalisation and adopted by the French railways.

It is impossible here to mention the subjects of all the specifications, but their scope includes all the materials, metallic and non-metallic, generally employed in the construction of locomotives, rolling stock and other railway equipment, mechanical parts and fittings, motor oils, lubricants, brakes, electrical accessories, and so on. Even such supplies as writing paper, toilet paper, and soap are included. In each case general conditions are specified, instructions are given for sampling and testing, and the results to be obtained are stated. In general, the specifications are commendably concise and practical, and they are of incalculable value for purposes of general reference and instruction even to those who are not bound by them. A list of the specifications in numerical order is presented in a separate booklet, uniform with the others, and against each there are noted the dates of origin and of the latest revision. The "loose leaf" form of publication has obvious advantages, particularly as the portfolio is instantly adjustable in thickness by a tongue and pocket device. The documents are all obtainable separately, at prices ranging from fr. 1 to fr. 24 each, and anyone responsible for the specification, purchase, or supply of railway materials should obtain at least those parts of this collection which bear on the materials with which he is concerned.

The House of Angus.—There seem to be comparatively few business houses still flourishing that can claim a record of progress through six reigns, and when one of the few publishes an historical brochure it is almost certain to be of considerable interest. These remarks apply with particular force to the booklet just produced by George Angus & Co. Ltd., of St. John's Works, Newcastle-on-Tyne, which manufactures leather, rubber, and textile belting and gearing of all descriptions, hose of all types, including fire hose and huge hogger pipes for dredgers, and brake linings. Ever since 1584, when one Alexander Angus fled from Scotland at a time of religious persecution, the Angus family has been represented in the county of Northumberland, and apparently from earliest times has been linked with the leather trade. The present firm claims its descent from 1789-90 when William Angus, the great-grandfather of the company's present chairman, established the business. In 1843 the firm began handling rubber as well as leather, and the present company was incorporated as a limited company in 1888. The story is one of continuous expansion, and the well-illustrated details of the firm's modern equipment combine with the historical pictures in producing an interesting and informative brochure.

Aluminium Facts and Figures.—This publication, which although of small dimensions contains 182 pages, is packed with useful information regarding aluminium and the uses to which it can be put in a wide variety of forms; indeed, there is hardly anything worth while saying that has been left unsaid in this very handy and informative little book. Published by the British Aluminium Co. Ltd., it supersedes the previous issue and contains a large amount of well-arranged tabulated data, together with an amplitude of text matter covering the whole subject of aluminium in alloy and other forms and their uses. We ourselves have already found it very useful as a text book on what is essentially a highly technical subject, and we therefore think that all users, or prospective users, of aluminium products will find it essential to acquire a copy. Even to summarise all the phases dealt with would require more space than we have available, and we think it will serve the interests of aluminium users best to say that the new issue of "Aluminium Facts and Figures" is as fully comprehensive as can possibly be required, and that everything appearing in its pages bears the stamp of accuracy and full authority.

XUM

THE SCRAP HEAP

In the early days of the railways the stage coach proprietors fought hard to retain their patrons who were disposed to try the new form of travel. One of them published an advertisement in South Wales, part of which was quoted recently in the *Western Morning News* as follows:—

Wives, Mothers, Sisters, and Aunts,
Beware
of the Railway
Avoid a dreadful death and
Mutilation
Go By Stage Coach
This is by far the Safest and most
Pleasant mode of
Travelling

* * *

MOSCOW SPREADS ITS BOUNDARIES

Powdered coal is to be the fuel of a new type of locomotive now being designed at the Lugansk Works in Moscow.—*From a bulletin of the Soviet Union Year Book Press Service.* [Lugansk is in the Don Basin, just 500 miles from the Ljubianka.—ED.].

* * *

THE OBEDIENT BEES

It is reported from Canada that passengers alighting from a C.N.R. express to stretch their legs at an intermediate station were recently alarmed by several hundred bees emerging from a container on the train and beginning to fly up and down the platform in warlike formation. Those who attempted to defend themselves, however, found their fears were groundless, for (we are told) as soon as the conductor cried "all aboard" the whole flight wheeled and swooped back to its travelling home with excellent discipline. The same performance is said to have been repeated at all stations between Alabama and Prince Edward Island.

* * *

NERVE

Three boys have been admonished, and more, by the magistrates for carrying too far and in the wrong place the generally admirable fondness of the young for competitive physical activities with a spice of risk. These lads chose a game which needs, it is true, elaborate apparatus, more elaborate than for polo or yacht racing, but it is equally a game which is within the reach of all. They loved to lie with their heads on a railway track, waiting for approaching trains, and whoever kept his head there longest was rightly judged to have won the contest for the best nerve. The railway companies and their engine drivers did not enter into the spirit of the thing, and complained of the nuisance it was having to stop because one of the competitors was in particularly good and reckless form. Lying down in front of oncoming vehicles is a well-established method of protest, which has often succeeded in human history. Rajahs have asked what was stopping the elephants, and have learnt for the first time that some of their subjects were aggrieved. The petition is handed up, read and agreed to, and all is well. But these British youths had no petition to proffer, no concessions to beg over such matters as platform tickets, and the disgust can be imagined of engine drivers who assumed that, at the least, they were confronted with an exciting political demonstration, and met the news that it was but another nerve contest in a world where compulsory nerve contests are part of the natural order.—*From a leader in "The Times."*

* * *

They tell this story of a couple of green brakemen working out of Edmonton on their first run: They reached a stopping place, and one brakeman was ordered to scrub out the caboose. The other was sent along the train to see that all the hose connections were in place, and then instruct the engineer. The hose connections were examined, and the engineer told to "go ahead."

"Go ahead what?" asked the puzzled engineer.

"Go ahead and shoot the water through so that other fellow can wash out the caboose."—*From the "Edmonton Journal," Canada.*

* * *

An incident which we believe has never had a parallel in railroad history occurred last Thursday on the Burlington and Missouri River, between this city and Denver. . . . We have it from a source which is a guarantee of its correctness.

It will be remembered that on Thursday (March 26), there was a wind which amounted almost to a tornado. At Akron (112 miles from Denver) it unroofed the round-house and did other damage. About 5 o'clock that evening, the wind, at its strongest, started a train of eight box cars loaded with coal that was standing on the side track. This eight-car train ran through the split switch and on eastward over the main track. The track was nearly level, but some distance this side it is down grade, and the wind was so strong that it moved the cars more rapidly than passenger train speed.

The operator at Akron noticed the runaway train as it broke loose and sent the alarm down the line. Everything was side-tracked and the crazy train had the right-of-way. The Cannon Ball train westward was side-tracked just in time. Marvellous as it may seem, those runaway cars ran 100 miles, passing eight stations, over a track which is for a great part of the distance almost perfectly level, with no propelling power but the wind and their own inertia. They ran the hundred miles in less than three hours, station agents and others holding their breath with awe as it whirled by at high speed. It passed Haiger (69 miles from Akron) at about 40 miles an hour, and on the down grade east of Akron, is estimated to have run 20 miles in 18 minutes. At Benkelman, 95 miles from Akron, a freight engine was run out following the runaway train, and after a chase of a few miles, closed the gap between itself and the freight cars, and was coupled to them.—*From the Lincoln (Nebraska) "State Journal" of March 30, 1884.*

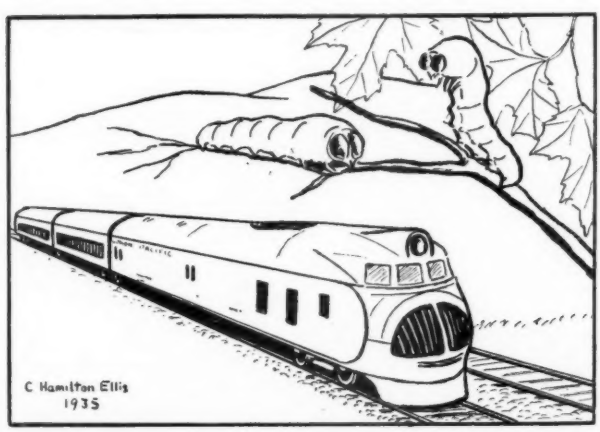
* * *

A class was given the task of writing four lines of dramatic poetry, says *Tit-Bits*. The results were various, and, selecting the verse of a usually bright boy, the teacher read:—

A boy was walking down the track,
The train was coming fast,
The boy stepped off the railway track
To let the train go past.

"This verse is very well done," said the teacher, "but it lacks drama. Try again, Johnny, and make it more dramatic." Whereupon, in a surprisingly short time, Johnny produced the following:—

A boy was walking down the track,
The train was coming fast,
The train jumped off the railway track
To let the boy go past.



Informative caterpillar: "There you are, Clarence, they have to go through the larval state, just as you and I do."

OVERSEAS RAILWAY AFFAIRS

(From our special correspondents)

ARGENTINA

State Railways Office in Buenos Aires

A decree issued by the Ministry of Public Works authorises the State Railway administration to draw on the renewals fund to the amount of $2,000,000 paper, to be expended on completing the administrative offices in the zone of the New Port at Buenos Aires, the construction of which was suspended several years ago. The proposal to erect the offices in the first instance was opposed on the ground that as none of the State Railways had its terminus in Buenos Aires, the heavy expenditure involved was not justified. The decree in question points out, however, that by centralising the staff in one building instead of its being located in offices scattered throughout the city, as at present, a saving of some $20,000 paper a month in rent will be effected.

Locomotive Engineers' Dinner

This dinner was held in the restaurant of the B.A.G.S. (Plaza Constitución) terminus, Buenos Aires, on September 20. Mr. Ormond Steven, M.C., M.I.Loco.E. (Chief of Operation, B.A.G.S.R. & B.A.W.R.) presided over a large gathering. After the customary toasts of " The President of the Argentine Republic " and " The King " had been honoured, Mr. J. M. Eddy, C.B.E., a Director, B.A.G.S. and B.A.W. Railways, proposed the toast of " The South American Centre of Locomotive Engineers," and in a short speech reviewed the history and growth of the Centre since its inception, in 1920, on the initiative of Mr. M. F. Ryan, C.B.E., a Past-President of the parent institution in London. Mr. Eddy also referred to the useful work which the institution was doing. Mr. E. C. Noble briefly responded on behalf of the Centre. Mr. Ronald Leslie, General Manager, Central Argentine Railway, in a witty speech, proposed the toast of " The Guests," with which he coupled the name of Mr. C. R. S. Harris, Director-General of the B.A.G.S. and B.A.W. Railways, who was attending his first Locomotive Institution dinner in Argentina. In his reply, Mr. Harris spoke of the progress which had been made in locomotive engineering during recent years, and expressed the opinion that this was due to the healthy competition of the internal combustion engine, a competition which he considered contained the seeds of a wonderful future: he also referred to the results that had been obtained by the steam engine on British railways. The chairman read a cablegram which had been received from the parent institution in London, conveying the greetings and best wishes of the President and Council for a happy gathering. The concluding speaker of the evening was Mr. M. F. Ryan, C.B.E., General Manager, B.A. & Pacific Railway.

Institution of Mechanical Engineers

On September 9, Major R. K. Hubbard, O.B.E., A.M.I.Mech.E. (Eng.), Stores Superintendent, Central Argentine Railway, delivered a lecture before a meeting of the above branch on " Fluid Transmission." The Chairman of the branch, Mr. A. T. Nickson, M.Inst.Mech.E., presided, and the lecture, which was of a highly technical nature, was followed by an interesting and lively discussion.

PERU & BOLIVIA

Power from Lake Titicaca

According to a Buenos Aires press report, a local banking firm is engaged in negotiating a contract for the utilisation of the waters of Lake Titicaca, between Bolivia and Peru—the highest navigable sheet of water in the world, 12,500 ft. above sea level—as a source of electric energy, for the purpose of electrifying the Bolivian railways and for the mining and other industrial enterprises of that republic. By this means work would be provided for about 20,000 soldiers demobilised after the Chaco war. It is calculated that the undertaking will involve an expenditure of £5,000,000 sterling.

Labour Agitation

News from Arequipa indicates that the railways have lately experienced a recrudescence of the labour troubles which occurred in July last year and resulted in a strike which lasted about a week, and was referred to in THE RAILWAY GAZETTE of August 31, 1934. During the first week of August last the railway federations, following a series of disputes over some minor matters relating to internal working, issued an ultimatum to the effect that if their demands were not complied with within 72 hours, a strike would be declared. The Government, after warning the federations that a subversive movement of this kind would not be tolerated, arrested the ring-leaders and declared martial law throughout the departments of Arequipa, Cuzco and Puno. This prompt action on the part of the authorities nipped the movement in the bud, with the result that the effects of the strike, which collapsed almost at once, were not very serious and the train services were not interfered with to any great extent. One or two attempts at cutting the line at isolated points were reported, but the declaration of martial law and the vigilance of the military and police effectually prevented any overt acts of violence.

NEW ZEALAND

To Make Crossings Safe

During the next three years the Government proposes to spend £360,000 in eliminating railway level crossings throughout the Dominion. The programme mapped out provides for the allocation of £120,000 each year for this purpose. An agreement to this course has been reached as to the allocation of cost between the Main Highway Board, the Unemployment Board, and the Railway Department, together with such assistance as will be forthcoming from local bodies. Investigations have been carried out jointly by railway and Public Works engineers at fifty of the most important level crossings in the Dominion, and from these a selection will be made for the programme for the current year. Elimination will be effected in some instances by overbridge, in some by subway, and in others by highway deviation, and in a few cases a small relocation of the railway may offer the cheapest and best solution.

Careful consideration has been given to the matter from the points of view of the road user and the rail user in relation to the amount of risk involved in each case, and also from the point of view of the Unemployment Board, which is desirous of finding full-time employment of a national character for certain classes of the unemployed. It is recognised that while the total number of accidents in the running of the railways is not excessive when the total annual mileage covered by goods and passenger trains is taken into account, accidents at level crossings form a rather large proportion of such happenings, and it is thought advisable and the time opportune to minimise these risks as far as possible.

An Unusual Mishap

In August both enginemen on a north-bound goods train running through a tunnel at Porootarao, on the North Island main trunk line, were gassed. As the northern portal of the tunnel is close to Porootarao station yard, where the train was admitted to a siding, the derailment of the engine and several trucks of live-stock occurred, and the engine capsized. The accident was the subject of a departmental inquiry by the chief executive officers of the Locomotive, Maintenance, and Traffic Branches, whose report and finding were transmitted to the Government Railways Board.

Commenting upon this finding subsequently, Mr. Mackley, the General Manager remarked: " The finding confirms the earlier conclusion that the accident was due to a most unusual combination of unfavourable circum-

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stances resulting in the presence of a small though sufficient quantity of carbon monoxide gas in the cab of the engine to overcome the men on the footplate. This conclusion is supported by the doctor who examined the men shortly after the accident and also by the doctor who attended them immediately after their arrival at their home station. Other professional men, including a Government analyst, also subscribe to the view expressed by the inquiry board."

Continuing, Mr. Mackley said that no identical case had ever before occurred in New Zealand. The conditions, both in relation to the accumulation of gas and its escape from the firebox in small though sufficient volume to overcome the men before the atmospheric conditions or movement of the train could dissipate it, would, he was assured by professional men of standing, require to be perfect, and they held the view, as did the departmental experts, that the likelihood of so complete a set of unfavourable conditions again developing was extremely remote.

INDIA

Railway Conference

Continuing his speech at the I.R. Conference session, the Hon. Member for Railways referred to road competition, and advised the railways to bring home their services—at least so far as goods traffic was concerned—to the people in the same manner as motor transport concerns did. To popularise the railway passenger services, Sir Zafrulla suggested the desirability of impressing upon the subordinate railway staff the need of greater consideration for passengers.

While appreciating the substantial economies in working expenses that had been effected since 1930, the Railway Member stressed the need for a continuation of the most stringent economies. The problem of ticketless travellers was also one that called for constant vigilance on the part of the railways. In regard to the revision of the general classification of goods, Sir Zafrulla warned those who were eagerly awaiting the deliberations of the conference that they might discover that the revised classification did not necessarily mean a reduction of rates. The Railway Member concluded with a tribute to the conduct of the N.W.R. staff in the Quetta earthquake.

Sir Otto Niemeyer's Inquiry

The Finance Member had occasion to refer to railway finances during the Assembly debate on the proposed inquiry by Sir Otto Niemeyer into the Central Government finances under the new constitution. He did not pretend that the railway position was reassuring, but said that if there still remained the prospect of a deficit, that would be a material factor in Sir Otto Niemeyer's report.

It was expected that the discussion in the Assembly on the report of the Public Accounts Committee, fixed for September 25, would lead to an indication of the Finance Member's proposals for the restoration of the railways to a position of solvency, but the Assembly agreed to postpone the discussion until the Delhi session. The Auditor General, in forwarding the railway appropriation accounts, observed that the former tendencies towards overcapitalisation were still in evidence. Further, according to the admission of the Financial Commissioner of Railways, the complicated financial problems connected with the scheme for the administration of the railways under the new constitution were still far from a settlement. This was a position which the Auditor General considered exceedingly unsatisfactory.

SOUTH AFRICA

Improvements at Germiston

In order to eliminate four level crossings, reduce the length of line by nearly a mile and its curvature by 218 deg., but—more important still—to make room for improvements at Germiston marshalling yard, the S.A.R. & H. administration has decided to construct a new line from Knights Cabin to Elandsfontein at a cost of £145,000. It is anticipated that a large number of traffic movements at the east end of Germiston yard will thus be facilitated or eliminated. The new construction work is likely to take about two years.

JAPAN

Improvements and Accelerations

The completion of the electrically operated Tanna tunnel route has released 29 heavy steam locomotives for use on the Najano-Naoetsu section of the Shinetsu line, where speeds are to be increased by 10 or 15 per cent. Several other lines near Tokyo are also to be improved and speeded up. On the Osaka-Aomori through main line, track and bridge strengthening is to be undertaken with a view to running heavy streamline locomotives between those cities and so reduce the time from 21 to about 12 hours.

Rail and Air Co-operation

Regulations covering the issue of through tickets, the interchangeability of tickets, transportation between railway stations and airports, and other matters of common interest, were to have been put into force on October 15 by the Japanese Government Railways, the Japan Air Transport Company, and the Manchukuo Air Transport Company. The Japanese Government Railways lines included in the scheme are the Tokaido and Sanyo main line Tokyo-Kobe-Shimonoseki, and the Kagoshima main line on the Island of Kyushu. The steamship service involved is that between Shimonoseki and Fusan, and the Japanese air line connects Tokyo, Nagoya, Osaka, Fukuoka, in Japan, Urusan, Keijo (Seoul), Heijo, and Shingishu in Chosen, and Dairen the Manchurian port in Kwantung leased territory. The Manchukuo air lines connect Dairen and Shingishu with Mukden, Hsinking, Harbin, Tsitsihar, Manchouli, and Heiho. Interchange stations will be Nagoya, Osaka, Fukuoka, Shingishu, and Dairen for the present. The South Manchuria Railway, the Chosen Government Railways, and the Manchukuo State Railways will join the scheme later. This co-ordination in so far as Japan proper is concerned came into force at the end of September.

MANCHUKUO

Railway Unification

When the South Manchuria Railway entered into an agreement with the Manchukuo Government in 1933 to administer and operate all State-owned lines, in consideration of the debts owed to the company by the State; the former established a Directorate-General under Mr. Kanji Usami, one of its own directors, to supervise the working of those lines. Now that conditions have altered so considerably, and railway operation throughout the country has been so closely unified, the abolition of the Director-Generalship is being considered: its duties would devolve upon the Railway Bureau.

Manchukuo to supply China with Coaching Stock

Mr. Yin Tung, Managing Director of the Peiping-Mukden Railway, arrived at Dairen from Tientsin on September 17 for the purpose of arranging for the purchase of rolling stock for the Peiping-Mukden Railway from the South Manchuria Railway at a cost of approximately Y.1,690,000. A contract for the construction of 24 carriages for the Peiping-Mukden Railway is reported to have been signed that day by Mr. Yin and Mr. Kanji Usami, Director of the South Manchuria Railway Company. The carriages, forming two complete trains, will be built at the cost of Y.1,380,000 at the Shahokou works of the S.M.R. and delivered by September, 1936.

Through Traffic with China

Conversations were also held at the South Manchuria Railways head offices in Dairen, in the middle of September, between Mr. Yin Tung and Mr. Usami, on the subject of through traffic. The northern part of the Peiping-Mukden Railway is in Manchukuo territory, and this section is being operated by the Manchukuo State Railways. At present one through express train is running between Peiping and Mukden in each direction; other trains necessitate a change at Shanhaikuan, the border station. It is intended to put on additional through trains and

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services. It is for its share of these services that the Peiping-Mukden Railway requires the 24 coaches which the S.M.R. is to build.

CHINA

Canton-Hankow Construction

The extension of the Canton-Hankow Railway between Pingshek and Lochiatu has been completed, and traffic operations on the section began early in September.

Cold Storage Equipment

A much-needed facility in a country like China, which has an annual period of tropical heat, is the provision of cold storage on the various railways. It is now reported that such a scheme is under consideration, and that cold storage plants are to be installed first on the Peiping-Mukden Railway, the Tientsin-Pukow Railway, and the Nanking - Shanghai and Shanghai-Hangchow-Ningpo Railways. A loan of $2,500,000 is to be raised locally for the purpose.

SPAIN

The Railway Companies Association

The Association General de Transportes por Via Férrea held a general meeting in Madrid on October 2 and 3, attended by representatives of practically all the Spanish railways. The principal subject for discussion was the Bill now being framed by a Parliamentary commission. The executive committee of the association described on general lines how it had assisted in the work of the commission by placing at its disposal the statistics and other information available in the records of the association. Among other matters discussed, was the continued competition of pirate lorries on the roads. It was agreed to draw up the conclusions and present them to the Minister of Public Works, and to this end an audience was granted by the Minister to a deputation of the members, during which he was asked to support the companies whose present precarious situation is due to unbridled competition of motor lorries, aggravated by recent social legislation and the compulsory use of high-priced Spanish coal and lubricants.

U.S.S.R.

Goods Traffic

During 1934 the tonnage of freight carried on the railways of the U.S.S.R. increased by 17 per cent. to 316,000,000 tonnes. Figures given by Soviet officials for the goods tonnage during the present decade are as follow:—

	1930	1931	1932	1933	1934
Millions of tonnes ..	238·7	258·2	267·9	268·1	316·0

The total for 1934 included 20 million tonnes of iron, 14.3 million tonnes of other metals, 82·2 million tonnes of coal, and 20 million tonnes of naphtha. Despite the increase in traffic, the average kilometrage per locomotive per day was only 169, against the 180 of the second Five-Year Plan. According to Soviet literature, 27,000 goods wagons and 2,600 passenger carriages were built in 1934.

Locomotive Developments

Recent reports from Moscow indicate that the 1935 programme for the building of 1,485 locomotives, including 470 of the 2-10-2 type, is now 75 per cent. completed. There are now 250 of the Russian-built FD 2-10-2 locomotives in service. Experiments with a pulverised fuel locomotive are be undertaken in the near future, and, if successful, will open up a new field for using coal of a quality that is at present unusable for locomotives.

Developments in Siberia

Messages from the Far East report that M. Andreyve, Commissar for Railways in Moscow, has announced important developments pending in Siberia. The completion of the doubling of the Trans-Siberian Railway throughout its entire length is to be hastened as much as possible. Also a network of feeder lines is to be constructed in the territory north of Manchukuo, and will include an alternative line which will be available in the event of the eastern sections of the Trans-Siberian line being disabled.

BARBADOS

Select Committee's Report

The select committee of the House of Assembly, under the chairmanship of Mr. G. D. Pile, which was appointed to consider the message submitted by the Governor prior to his sailing from Barbados on leave last June, has issued its report. The main feature of this report is that a Bill embodying the following points should have a reasonable chance of meeting with the approval of the House next Session:—

(1) The Barbados Railway should be under the control of a board of seven members to be appointed annually; two members to be appointed by the Governor, one member by the Legislative Council, and four members (two of whom shall be Members of the House of Assembly) by the House of Assembly.

(2) This board should report every six months on the condition and working of the railway.

(3) The railway should be under the management of a qualified railway engineer who should be appointed and dismissed by the board subject to the approval of the Governor-in-Executive Committee.

(4) The Manager of the railway should receive a salary of £600 per annum, rising by annual increments of £25 to £700 per annum, and the office should be pensionable.

(5) The Governor should have power at any time to appoint an engineer to inspect and report on the condition of the railway, and an accountant to inspect and report on the books and accounts of the railway.

(6) The Governor should have powers similar to those he had by virtue of subsection (1) of Section 5 of the Barbados Light Railway Limited Act, 1908–11, to take action on any such report, if necessary.

(7) The railway should be vested in the Governor-in-Executive Committee.

The committee considers that the Manager of the railway should not be appointed until legislation on these lines has been passed.

BRAZIL

Railcars for Central of Brazil

The contract between the Central Railway and the Fiat concern for the purchase of railcars, which has been the subject of deliberations for several months, was signed by Col. Mendonça Lima, Director of the Central, and by the representatives of Fiat in Brazil on September 25. Fiat undertakes to deliver, within 12 months of the registration of the contract by the Accounts Tribunal, five Littorina twin articulated railcars for the operation of fast passenger services between Rio and São Paulo and Rio and Bello Horizonte.

Each railcar set will seat 160 passengers, carry air-conditioning plant and be capable of averaging 85 km.p.h. over ruling gradients of 1 in 120, which will give times of approximately 6 and 7½ hours between Rio and São Paulo and Rio and Bello Horizonte, compared with the present quickest bookings of 11½ and 14½ hours respectively.

Their total cost will be 5,200,000 lire, or at the ruling exchange rate, roughly 7,500 contos, and payment will be effected by instalments, 50 per cent. of the revenue earned being reserved for this purpose. It is expected that the full amount will be liquidated within three years, when the cars will automatically become the property of the Central Railway.

Traffic Agreements to Meet Sea Competition

As the Leopoldina Railway is exposed, in various sections of its *littoral* route from Rio and Nictheroy to Campos and Victoria, to competition from steamer services, traffic agreements, known as "ajustes," were recently concluded with certain transport agencies whereby each of the latter agrees to hand over during a fixed period a certain minimum tonnage of traffic to the railway for haulage between points previously determined. At the same time the firm pays the railway in advance a conventional rate per ton, chargeable on the minimum tonnage arranged and with no refund should this tonnage not be attained during the period, the firm, of course, being at liberty to collect whatever charges it pleases from the consigners.

Two such "ajustes" were drawn up this year, in May and July and each will remain in force up to the end of the year with possibility of renewal. Both "ajustes" aim at the securing by the Leopoldina of traffic proceeding from ports in the north and south of Brazil and destined for Campos, traffic which, hitherto, has been carried by the Costeira and Lloyd Nacional navigation companies. In each case a minimum quantity of 150 tons a month has been fixed, with a rate of 50 milreis a ton between Rio and Campos. Up to the present the scheme has proved advantageous to the railway.

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MOTOR TROLLEY MAINTENANCE OF PERMANENT WAY IN ARGENTINA—II*

Advantages obtained from the system instituted on the Buenos Ayres Great Southern Railway

By F. L. CRESWELL, Engineer-in-Chief, B.A.G.S. Railway

THE following advantages have been obtained by the reorganisation of gangs equipped with motor trolleys:—

1. Reduction of non-effective units.
2. Selection of foremen.
3. Improved mobility and better conditions of working.
4. Improved methods of working, with corresponding reduction in the number of men employed.
5. Suppression of horse allowances.
6. Reduction in plant and equipment.
7. Surplus living accommodation available for other departments.

1.—Reduction of Non-Effective Units.—The introduction of the motor-trolley gangs with long sections has permitted the reduction, from 496 in the year 1928-1929 to the present figure of 232, in the number of gangs, and consequently in the number of foremen and cooks. Of the 232 gangs employed, 69 are not equipped with motor trolleys, the majority of these being on the local sections.

The surplus foremen—married men in almost every case—are being employed as track-revisers or supernumerary foremen until such time as they reach pensionable age or are otherwise absorbed. They have retained the living accommodation originally allotted to them as foremen and this will become available once the posts are suppressed. The work performed by these men at the salaries paid cannot be considered economical, but the final establishment will include only six track-revisers who will be stationed at certain sections of the line where the services of men of this category are indispensable. The number of foremen has been reduced by 77, and some 200 are surplus.

As regards gang cooks, the practice is to allow one cook per gang; he remains at the gang headquarters to clear up the camp, split firewood and prepare the meals, but when the gang is working some distance from headquarters, the midday meal is prepared on the site by one of the gang. The cook is paid for all days of the week. The statement below indicates the considerable saving effected.

REDUCTION IN EXPENDITURE BY THE USE OF MOTOR TROLLEYS†

		$
1. *Reduction of Gang Foremen*		
Up to the present, 77 of the surplus gang foremen have been pensioned, but the services of a further 210 will be dispensed with as they become due for pension or are otherwise absorbed.		
Present saving—77 × 12 × $140 per month	..	129,360
Additional future saving—210 × 12 × $140 per month	..	352,000
2. *Reduction of Gang Cooks*		
Gangs suppressed—293.		
Cooks at gang headquarters—293 × 365 × $2·40 per day	..	256,668
Cooks with gangs (time not occupied in effective track work) 293 × 72 × $2·40 per day	..	50,630
3. *Reduction in Horse Allowances*		
Expenditure 1928-1929 .. .. $49,125		
Expenditure 1932-1933 .. .. $5,952		
Saving $43,263		43,263
4. *Reduction in Maintenance of Plant and Equipment*		
Allowing a depreciation of 25 per cent. per annum on the reduction on plant and equipment issued to the gangs, the annual saving is	.. ..	54,385

* The first of the series appeared in THE RAILWAY GAZETTE of October 4, 1935.

† The saving due to the reduction in men employed resulting from the use of motor trolleys is not included (see 4 below).

2.—Selection of Foremen.—The rate of pay of the permanent way men is low compared with other grades of labour in the country, good men remaining only until more remunerative employment can be obtained; consequently the standard of labour is not high. It is from this class that gangers must be drawn, and, as can be realised, many of those in charge of the old small gangs were mediocre. However, with the reduction in the number of gangs it has been possible to make a selection of energetic and competent men for the new and larger type of gangs. It should be remarked that the majority of the surplus foremen will never again be put in charge of gangs.

This selection has undoubtedly contributed towards the reduction in the number of men employed as more efficient gang working is obtained.

In order to retain promising men in the gangs with a view to the provision of future foremen, a first "peon" at a higher rate of pay is employed in each gang, these posts being filled by selected men.

3.—Improved Mobility and Better Conditions of Working.—With motor trolleys, the gangs arrive at the site of the work fresh and rested and punctually, which is in direct contrast to their condition when pump-trolleys were the means of transport.

On the B.A.G.S. Railway the practice is to box-in the track completely, and such practice allows of immediate detection of incipient sleeper movement, which is indicated by the state of the over-lying ballast. A logical development of this has been the practice now implanted throughout the system, of progressively overhauling the tracks, during the course of which all incipient movement is eliminated. In this connection it is to be noted that with tracks that are not covered-in to rail level, movement of sleepers does not become obvious until the slacks are pronounced.

The motor-trolley equipped gang has the great advantage in that it can immediately go to any part to effect urgent overhaul or to attend to track imperfections which have developed behind the gang. The fixed-flying gang, on the other hand, had the disadvantage that it was unable to return to effect track repairs once it had passed a given station, as this would entail, in all probability, a movement of the gang. The result was that slacks which had developed behind the gang were left until the latter was again located at the neighbouring station. It is possible also to concentrate men more quickly in case of accidents.

Even with the loss of two or three men at harvest time or through sickness, the gang is still effective, whereas under the old system of small gangs with a strength of six men, of whom one was the foreman and another the cook, the loss of one or two rendered the gang immobile. The new system is also much more elastic as it is possible to reduce the gangs during the summer months, when less track maintenance work is necessary, and increase them when required for heavy maintenance or special work without increased transport facilities, the living accommodation being so arranged as to provide for their periodic increases.

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With the small fixed gang it was not possible to carry out such operations as loading rails, loading and moving huts, or small special works, owing to the low strength of these units, and a flying gang had to be brought.

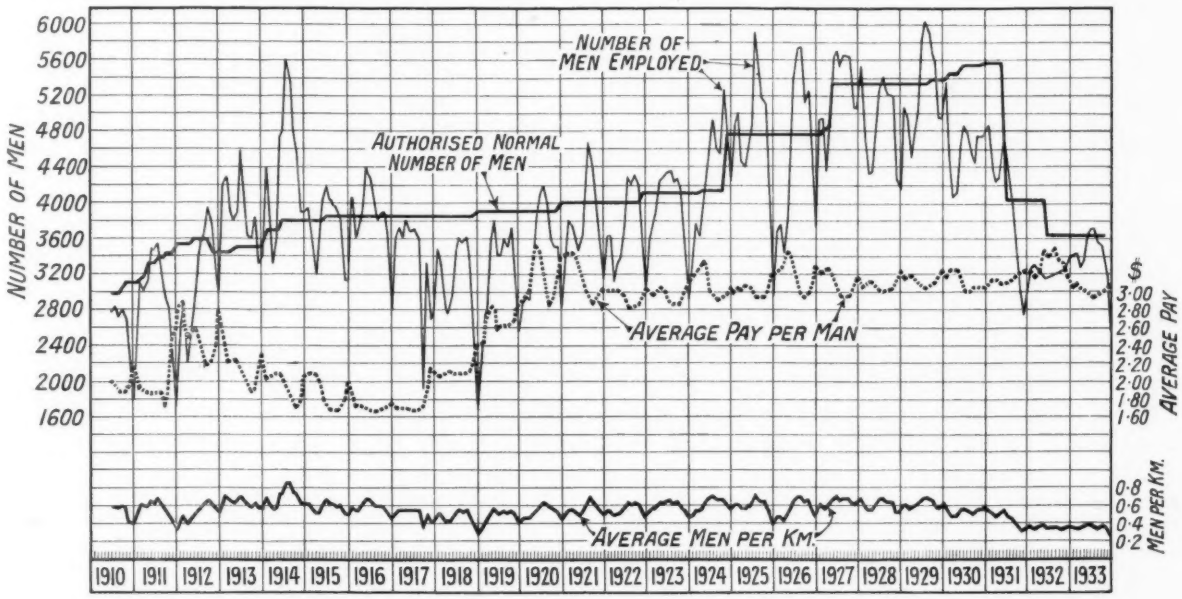
4.—Improved Methods of Working with Corresponding Reduction in the Number of Men Employed.—With the reduction in the number of permanent way gangs, better supervision is being obtained by the inspectors, especially those provided with light inspection cars, and by the technical staff, and it is now possible to record, in diagrammatic form, the work done by each gang. The data obtained from these diagrams, together with the Hallade diagrams recording the conditions of the tracks, have already led to further developments towards the reduction in the cost of maintaining the lines.

As a result of being able to select efficient foremen, in the fixed flying gangs occupying temporary living accommodation.

5.—Suppression of Horse Allowances.—Those small fixed gangs which were equipped with horse drawn trolleys were given a horse allowance of from $6.00 to $18.00 a month, paid to the foremen for the use of the horses. The latter figure was paid on the Neuquen line, where there is little pasture, and fodder constituted an expensive item. The rates varied between the figures quoted in accordance with conditions in the various zones.

By the use of motor trolleys, these allowances have in great measure been discontinued and will be completely suppressed once the surplus track revisers and gangers have been eliminated.

6.—Reduction in Plant and Equipment.—As the reorganisation has reduced the number of men employed, the plant and equipment issued to the gangs is also



Number of permanent way men employed over a series of years

and also due to the improved methods of working described above, it has been possible to make a considerable reduction in the number of men employed, but the consequent reduction in the expenditure has not been included in the statement of direct saving given in the table in 1 above, as this is coincident with a further reduction of men due to the restriction of work to a minimum during the present crisis.

From the accompanying diagram, it will be seen that the number of permanent way men employed during 1932-1933 is equal to that of 1912, although 55 per cent. greater length of line is now maintained, whilst compared with 1928-1929, the decrease in the number of men is 30 per cent.

Referring to the number of men employed per kilometre, indicated on the diagram, it will be seen that the reduction is considerable. A decrease is also shown in the average wage paid in spite of the 547 permanent "peones" employed since 1929, who are paid from $3.00 to $5.00 a day and granted periodic increases, compared to $2.40 to $2.80 a day paid to the ordinary "peones." The reduction is due to fewer foremen being employed and to the reduction of $0.20 a day paid to the men employed reduced, particularly such items as pump trolleys, jacks, &c., and other tools which have to be issued to each unit, representing a considerable capital saving and a corresponding decrease in the maintenance charges for replacements and repairs.

7.—Surplus Living Accommodation Available for Other Departments.—Once the reorganisation is complete —*i.e.*, when the whole of the surplus foremen have been eliminated—the living accommodation allotted to these men will become available for renting to employees of other departments at present housed in wooden huts and, where not required, will be dismantled and the materials produced used to extend the living quarters of the gangs in replacement of the more temporary type of accommodation at present provided. The number of additional huts diverted to provide accommodation for the new gangs is 131, but this will be reduced gradually as more permanent living accommodation becomes available.

The details of the direct savings under the above seven headings will be given in the concluding instalment.

[*We hope to publish the concluding article of this series in our issue of December* 6]

XUM

NEW 4-8-4 LOCOMOTIVES FOR CHINA

Twenty-four of these remarkable engines are being built by the Vulcan Foundry Limited. They are of exceptional size, and embody in their design and construction a number of interesting features

AN order for twenty-four locomotives of the 4-8-4 type with twelve-wheeled tenders for fast freight, passenger, and general traffic services on various sections of the Chinese National Railways is at present in hand at the works of the Vulcan Foundry Limited, Newton le Willows, Lancashire. The engines, sixteen of which are comprised in one order, with eight others to follow, are being purchased by the Chinese Government Purchasing Commission out of China Indemnity Funds remitted by the British Government, to the requirements of the Chinese Ministry of Railways and under the inspection of Messrs. Sandberg, Consulting Engineers, London.

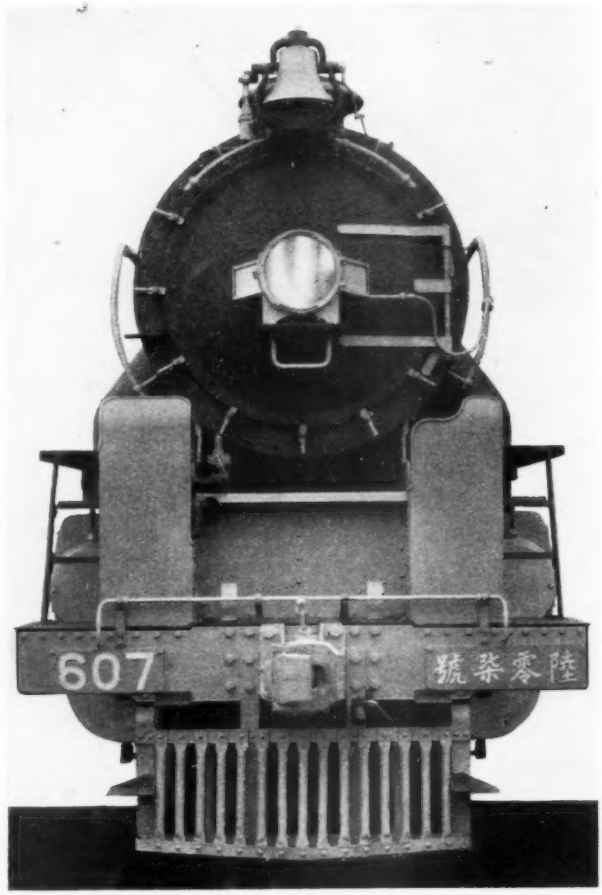
They are remarkable engines in respect of size, and their design incorporates several interesting features, drawings of some of which will be found on the folding plate accompanying this issue. Certain of these features have been largely influenced by the size and weight of the locomotives. The last six of the first consignment of sixteen will be equipped with booster engines driving the rear axles of the leading tender bogie. Outside coupling rods with balanced cranks connect these axles with the intermediate axles. In the remaining engines, the rear bogie of the locomotive itself is adapted for the ready application of a booster if required.

By the courtesy of the builders, we were recently afforded an opportunity of inspecting the locomotives already completed, and others in various stages of assembly in the works, and we were greatly impressed by the exceptional character of the design and general proportions adopted. Needless to say, the workmanship throughout is of the highest class, and although these are not actually the heaviest locomotives yet constructed by the Vulcan Foundry Limited, they rank as the largest in overall dimensions, and are within a ton or so of the highest weight standard previously reached.

The engines are built to negotiate curves of 150-m. radius and are suitable for maximum grades of 1·5 per cent. Six of the engines fitted with boosters are to run over the northern section of the Canton-Hankow railway, and four over the southern section of the same railway. The remaining six of the first order will be loaned for service on the Nanking-Shanghai railway.

Boiler Details

In the design of the boilers for these engines, the main characteristic apart from their large proportions, is the provision necessary for burning a low grade of coal. The firebox, with which is incorporated a combustion chamber, is noteworthy for its ample size, a remark which applies with equal force to the grate, built in four sections, whilst the ashpan is provided with ash-discharging doors, controlled from a hand-operated lever on the outside. The inside firebox is of steel, and so designed that Thermic syphons can be fitted if required. The firebox water space stays are of the flexible type in the breaking zone and around the combustion chamber, details of which are reproduced in the drawings on the folding plate. The roof stays are direct, with the exception of the front four rows which are of the flexible type. The boiler barrel is tapered, and a steam stop valve, fitted with external operating mechanism, is provided in the dome. A Tan-



Front end view of locomotive

gential steam drier is also located in the dome. Coal is fed into the firebox by a mechanical stoker of the B.K. type manufactured by the Vulcan Foundry Limited, by arrangement with the Standard Stoker Company. The driving engine for the stoker is accommodated on the tender. A firedoor of the sliding type operated by hand is also provided.

The arrangement of the superheater, which is of the MeLeSco " E " type with multiple valve regulator header, is somewhat unusual. There are 120 flue tubes, 3½ in. outside diameter by 10 w.g., and the superheater is comprised of 33 elements made from tubing 1⅝ in. outside diameter by 10 w.g., each element occupying 4 flues, with the exception of six which occupy only two flues. The elements have bends at the smokebox end protected from cinder cutting by a fitment of special shields round the bends. The large flue tube area naturally means that the number of small tubes is greatly reduced, there being only 50 of these, dispersed as shown on one of the accompanying drawings. The heating surface of the superheater

is 1,076 sq. ft., and the total combined heating surface of the boiler and firebox is 4,064 sq. ft. The boiler, firebox, and cylinders are covered with Alfol lagging.

The steam stand for the distribution of steam to the various fittings is in two sections, *i.e.*, one for saturated and the other for superheated steam, the latter being used for the mechanical stoker, Westinghouse air compressor, electric lighting turbo-generator, booster, and whistle. The whistle is of the chime pattern with five separate notes blending together and providing a melodious and at the same time penetrating sound. The boiler feed arrangements comprise two Gresham & Craven No. 10 injectors, supplying water to the boiler barrel through a top feed clackbox. The more important boiler fittings comprise pop safety valves, Everlasting blow-off cock, two Clyde soot blowers mounted on the sides of the firebox, Housley type arch tube and washout plugs, bell with pneumatic ringer, Sydney Smith's cut-off control gauge, and Gresham & Craven Vapor heating equipment.

The smokebox contains a system of deflector plates and wire netting forming a spark arrester and self cleaning arrangements, in accordance with the recommended practice of the Master Mechanics Association.

Cab and Footplate

The illustrations on pages 718 and 719 show the general lines of the cab and the footplate arrangements as a whole. Comfortable seats are provided for the driver and fireman, and we can testify to the excellent lookout afforded to both of them. One of the most interesting features is the cut-off control gauge referred to above. The use of this dispenses altogether with guesswork on the part of the driver, as the gauge enables him to adjust the cut-off correctly for the most economical and efficient working of the engine. The gauge shows the pressure in the steamchest when steam is on, and when the engine is drifting, also the exhaust pressure; the existence of a leaky regulator valve or a creeping reversing gear is also detected.

The working of the gauge is as follows: A duplex movement is provided, wherein two quadrants and pinions with their respective black and red hands are both operated by the Bourdon tube connected to the steamchest. Thus, as pressure is applied to this tube, both hands move together over the gauge dial and indicate the applied pressure. The movement frame associated with the red hand is pivoted and coupled to a second Bourdon tube, connected to the exhaust pipe, in such a manner that, as pressure is applied to this tube, the movement frame swings so that the red hand moves in the opposite direction to that due to increasing pressure in the steam pipe. Consequently, a differential action is set up, and the magnitude of the exhaust pressure is shown by the degree of rotation of the pivoted frame, or the amount of movement of the red hand away from the black hand. The construction of the gauge incorporates the necessary syphons for both the steam and exhaust pipes. Operations such as reversing, manipulation of the cylinder cocks, &c., are performed by the aid of compressed air.

The cab and footplate are electrically lighted, and lights are also provided for the inspection of the water and other gauges at close quarters; the equipment for this purpose was supplied by J. Stone & Co. Ltd. The large number of controls will be noted from the illustrations, but, as we found during our inspection, those most frequently required have been in all cases located so as to be easily within reach both on the driver's and fireman's side. The window spacing and ventilating arrangements are both excellently planned, and the cab, besides being capacious, affords what we should consider to be the maximum of comfort and convenience for the enginemen, the whole of the footplate being practically enclosed by means of a plate at the rear which protects them from draughts.

Main Frames, Cylinders and Motion

The main frames are of the bar type cut from rolled steel slabs, with a slab extension over the engine trailing bogie. A superstructure built up of welded plates and cross stretchers is carried by the bar frames for the support of the boiler barrel and smokebox, running boards, &c. The front bogie is of the built-up type with swing link control, and is fitted with oil lubricated axleboxes. The hind bogie is provided with plate frames and outside axleboxes of the Isothermos type. A three-point suspension system is provided for the engine by compensating the spring gear in two groups, the leading bogie forming one group and the coupled wheels and trailing bogie the second group. The load from the main frames is conveyed to the trailing bogie at three points, one at the forward and two at the rear as shown on one of the accompanying drawings. The load is applied at the rear end through rockers, the function of which is to stabilise the hind end and make the bogie self centring, without the use of spring centring devices.

The cylinders drive the second pair of coupled wheels, and steam distribution is effected by Walschaerts gearing with piston valve steamchests above the cylinders. Each cylinder and steamchest is cast in one with half of the smokebox saddle, the two sections being bolted together at the centre. The cylinder barrels and piston valve liners are of nickel cast iron. A noteworthy feature in this part of the construction is found in the somewhat exceptional size of the piston valves, namely $12\frac{5}{8}$ in. diameter, whilst the valve rod of the Walschaerts gear is fitted with a two-to-one extension to provide for a piston valve travel of 9 in. The crossheads are of the multiple-bearing type lined with white metal on the bearing surfaces, the object of the design being to provide as large a bearing surface as possible without undue length of crosshead. Inspection of the motion parts is facilitated by the provision of electric lighting permanently fitted under the running board. The lights can be switched on or off as desired for use after dark.

As already stated, the cylinders are fitted with air operated cylinder cocks, and United States metallic packings are used for the piston rods and valve spindles. Air sanding of the Gresham & Craven duplex type is used, from a sandbox mounted on the top of the boiler barrel behind the steam dome. Sand is delivered in front of the driving and behind the trailing coupled wheels. Westinghouse 6-ET type air brakes are fitted, and are being applied to all coupled wheels and those of the trailing bogie and tender.

The Tecalemit system of grease lubrication is used for all motion parts, namely coupling and connecting rods, gudgeon pins, coupled wheel hubs, eccentric cranks, brake and spring gear mechanism, and similar components. Ajax grease lubrication is applied to the axleboxes of the coupled wheels. The engine is equipped with Visco " D " type couplers supplied by the English Steel Corporation Limited.

Design and Construction of Tender

With a view to reducing dead weight as far as possible, the tender tanks are of welded construction. The bogies are six-wheeled, with outside frames and Isothermos axleboxes. On six of the tenders, *i.e.*, those of the last six engines in the first order, the front bogie is to be equipped with Stone's Class " D " type boosters, but the engines so fitted have not yet been completed. The two rear pairs of wheels of the booster-driven bogie will as

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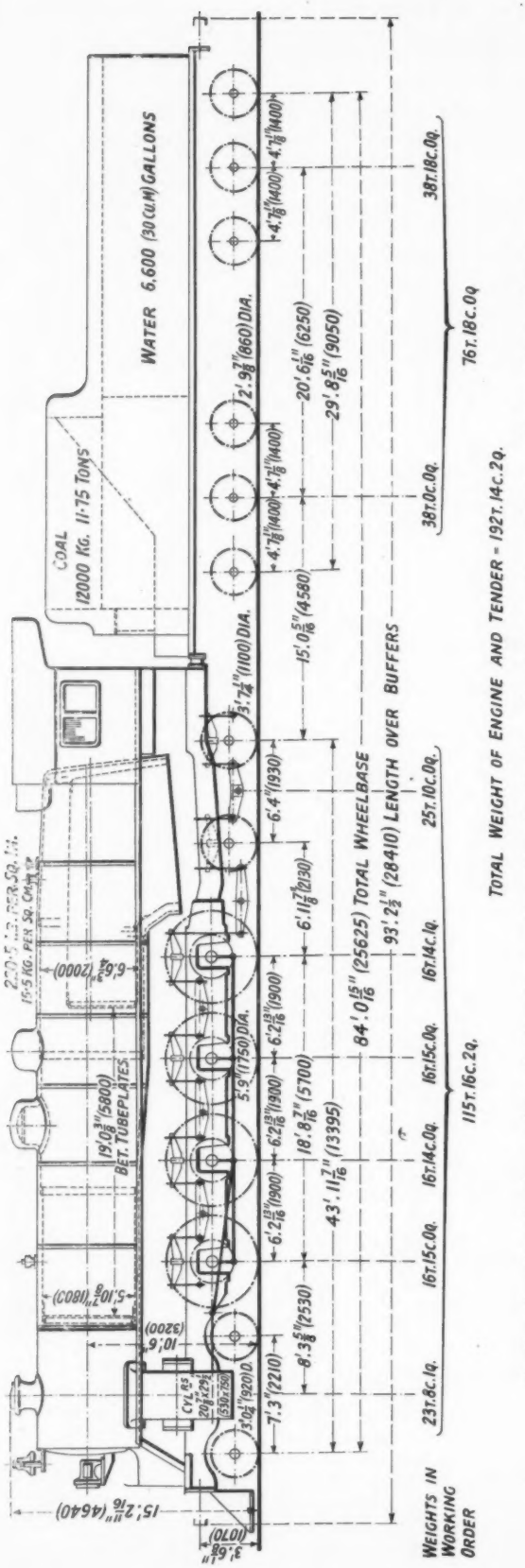

Outline drawing showing principal dimensions and weight distribution of 4-8-4 type locomotive for Chinese National Railways

stated be coupled by side rods having outside balanced cranks as shown in the accompanying drawings.

The central coupler at the rear of the tender is of the Visco " D " type fitted with Bradford Rocker type draft gear and Farlow Two Key attachment. Grease lubrication of the bogie centres, brake and gear springs is the Tecalemit system.

The following are the principal dimensions:—

Cylinders (2), dia.	20⅞ in.
Piston stroke	29½ in.
Wheels, coupled, dia.	5 ft. 9 in.
,, leading bogie, dia.	3 ft. 0¼ in.
,, trailing bogie, dia.	3 ft. 7½ in.
Wheelbase, rigid	18 ft. 8 7/16 in.
Total engine	43 ft. 11 7/16 in.
Wheelbase, engine and tender	84 ft. 0 15/16 in.
Length of engine and tender overall	93 ft. 2½ in.
Boiler height of centre from rail	10 ft. 6 in.
,, length between tubeplates	19 ft. 0⅜ in.
,, dia. at front end	5 ft. 10⅞ in.
,, dia. at firebox end	6 ft. 6¾ in.
Steam pressure	220·5 lb. per sq. in.
Heating surface :—	
Small tubes (50)	560 sq. ft.
Large tubes (120)	2,088 ,,
Firebox	312 ,,
Arch tubes in firebox	28 ,,
Heating surface, total, evaporative	2,988 ,,
,, Superheater	1,076 ,,
,, Combined total	4,064 ,,
Grate area	67·8 in.

The capacity of the tender is 11¾ tons of coal and 6,600 gallons of water. In working order the engine weighs 115 tons 16 cwt. 2 qr., 66 tons 18 cwt. 1 qr. of which are available for adhesion, and the tender 76 ton 18 cwt., a total of 192 tons 14 cwt. 2 qr. The engine develops a tractive effort at 85 per cent. of the boiler pressure of 32,920 lb.

In the case of the eight engines to be built when the present order for sixteen has been completed, the diameter of the cylinders will be increased from 530 mm. (20⅞ in.) to 540 mm. (21¼ in.), and it is expected that under usual service conditions these cylinders may be bored out to a still larger diameter. The connecting rods will be made of manganese molybdenum steel to compensate for the additional load they carry.

The inside fireboxes will be built of Colvilles special double crown brand firebox steel.

Two Mid-Pacific Railways

A short distance south of the equator, 160 miles from each other, and many miles from any other land, lie the islands of Banaba and Nauru, famous for their enormous deposits of very pure phosphate of lime. The story of the exploitation of this mineral has been entertainingly given by Mr. Albert F. Ellis, C.M.G., F.R.G.S., in a book just published in Sydney, Australia, under the title of *Ocean Island and Nauru*. Each of the islands has a railway system, operated by the British Phosphate Commission in connection with the phosphate workings. Both railways were originally of 2-ft. gauge; that of Banaba (Ocean Island) was the older, as it was begun in 1900. The author states that the important development of changing over the Nauru system to the 3-ft. gauge is now in progress. Though the railways find no place in the index to the book, incidents concerning them are recalled on several pages, and their extent is recorded on two folding maps of the islands. Most space is given to the Ocean Island line, of which the main track runs between Ooma and Tapiwa, the principal Banaban native villages and now European settlements as well. " Communication is quite good," writes Mr. Ellis, " as the commission runs a little motor train service to timetable; this is free to European residents."

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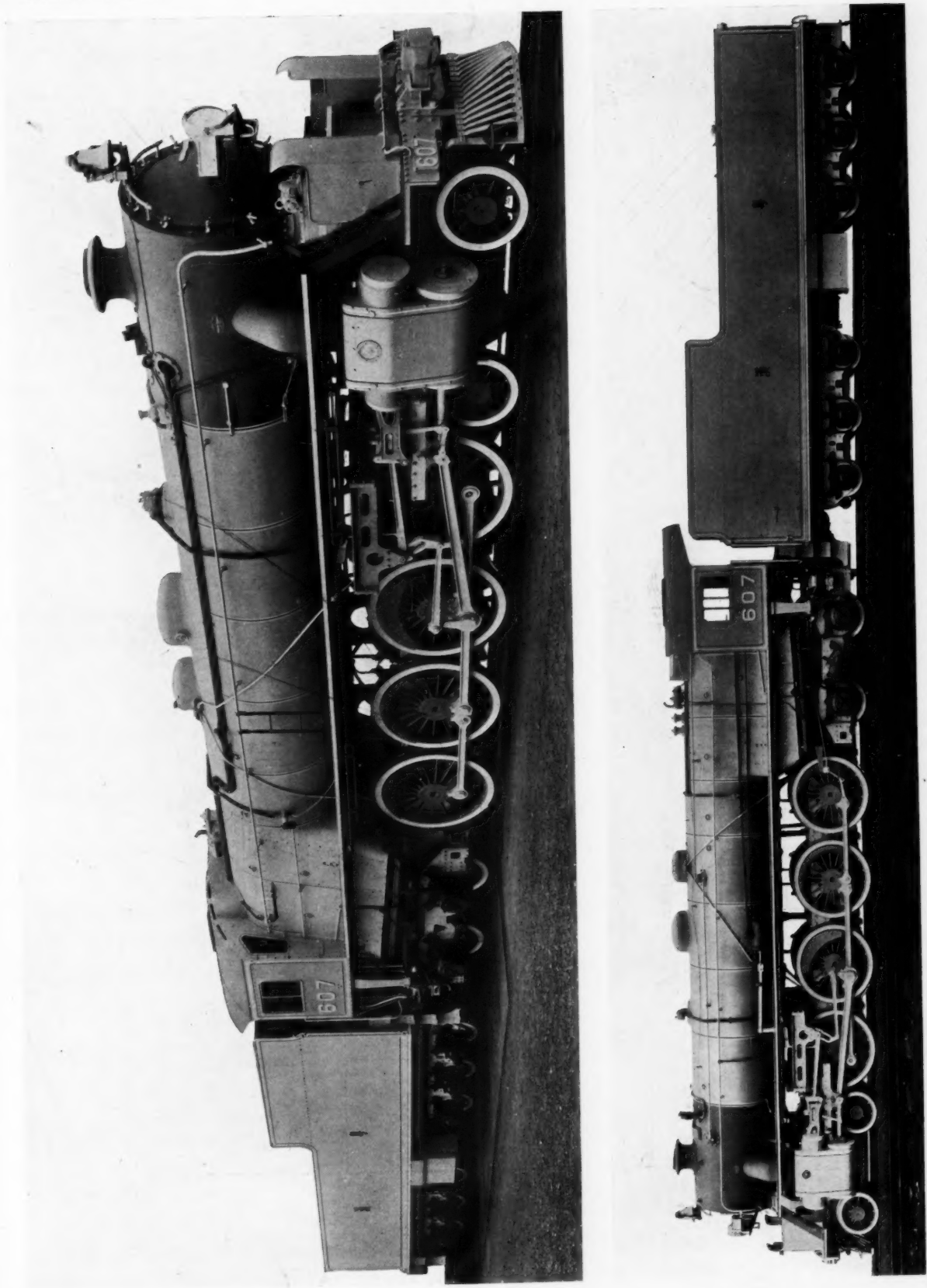

New 4-8-4 type mixed traffic locomotives for the Chinese National Railways, showing fittings on both sides

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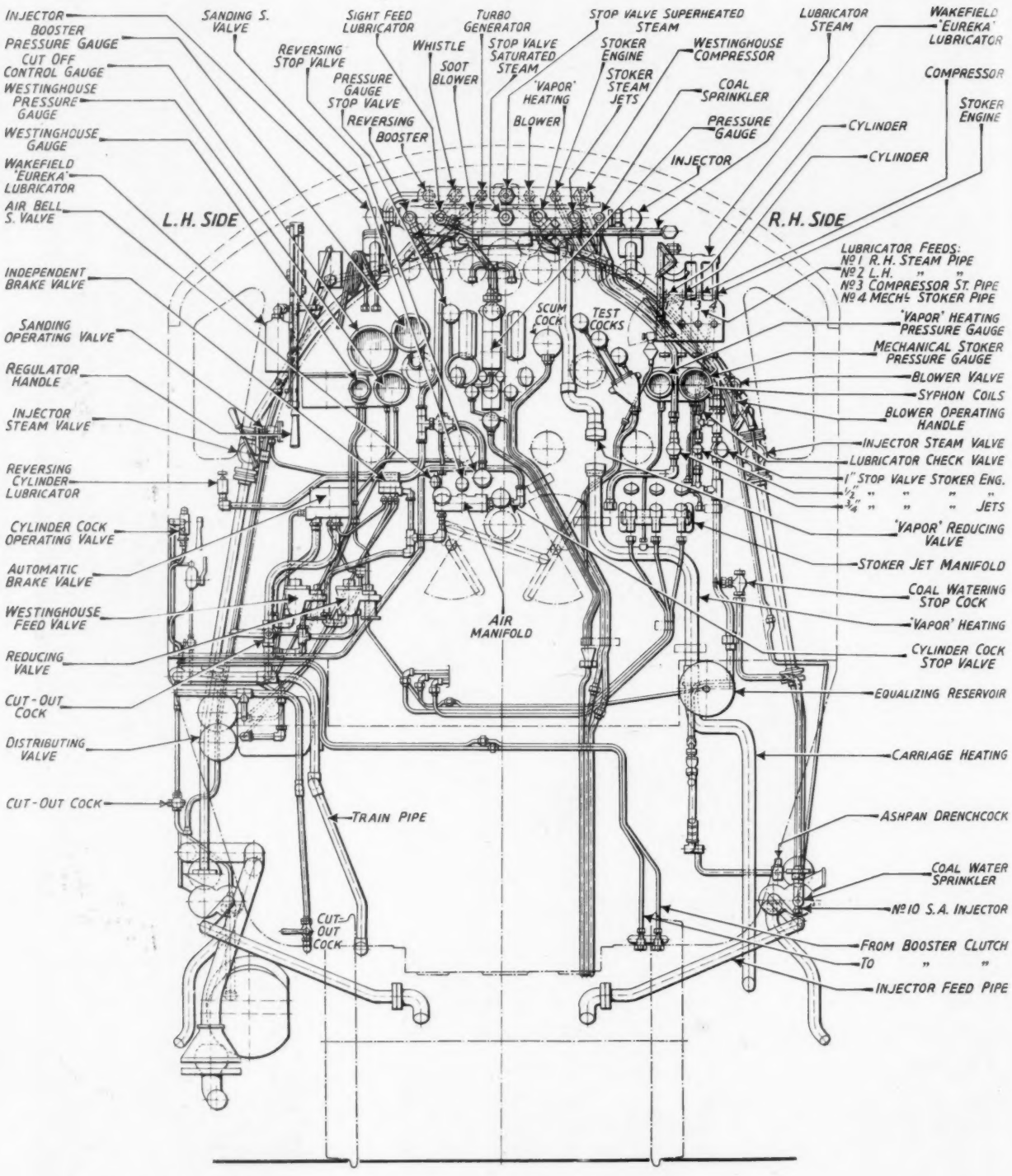
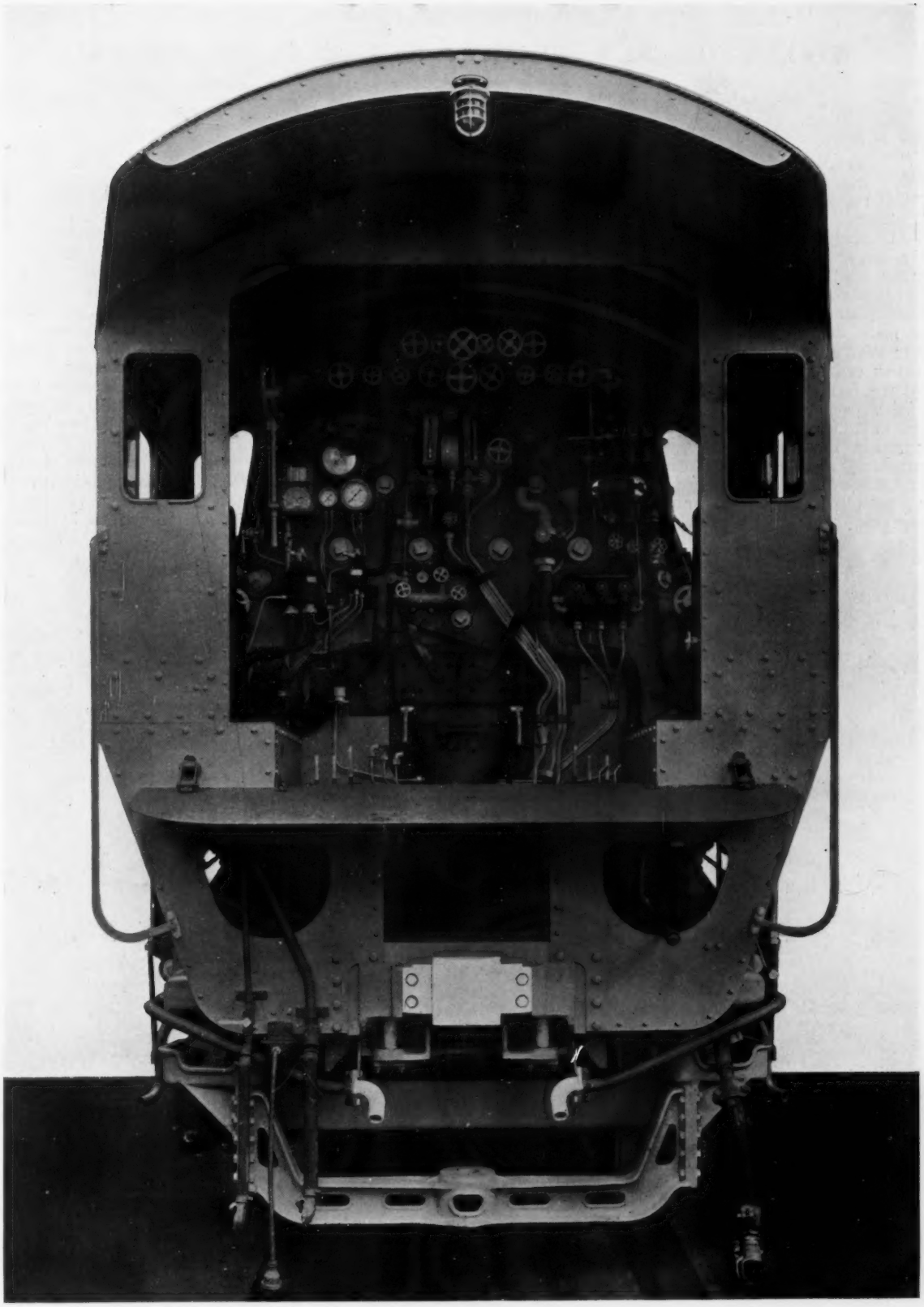


Outline drawing of footplate keyed to show the positions of the controls, gauges, &c.



General view of cab interior; new 4-8-4 type locomotives for China

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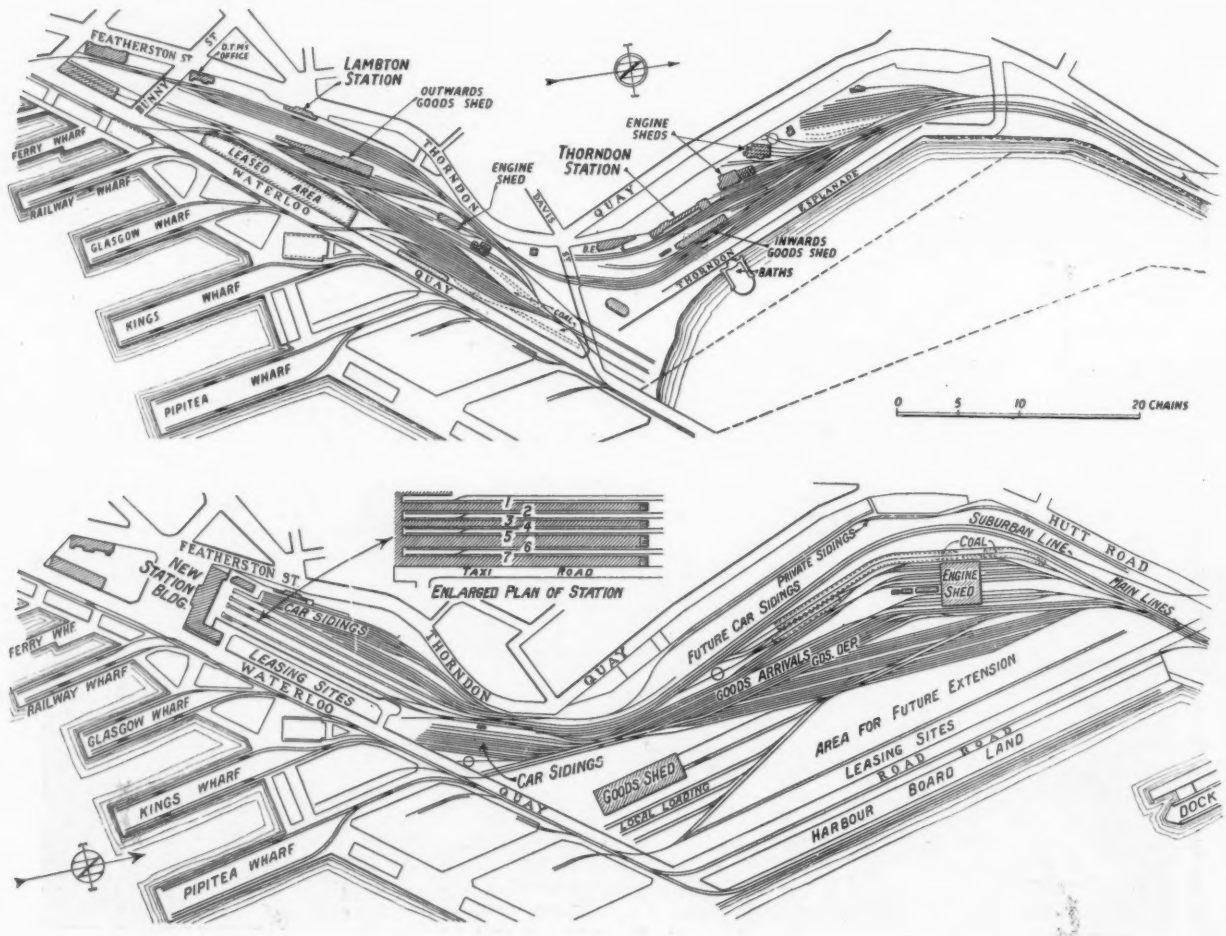
WELLINGTON NEW STATION, NEW ZEALAND RAILWAYS

Progress, not only upon the main buildings, but upon the yards, locomotive depot and signalling also, has been rapid, and is now briefly described

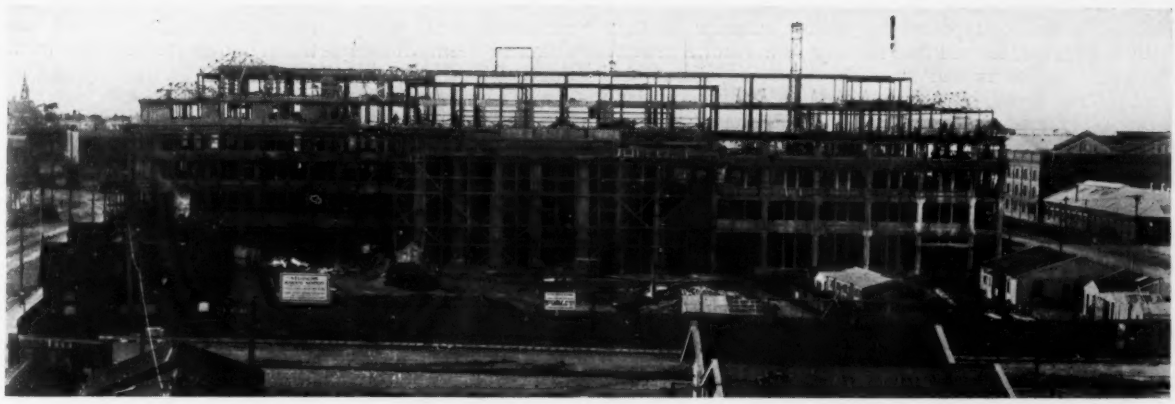
THIS important group of works, some features of which have already been dealt with in THE RAILWAY GAZETTE of November 10, 1933, is to be completed early in 1937, according to programme. Progress is up to time and many of the new shunting and car sidings and connections are already in their final positions as far as they can be until all the old yard has been lifted. The main station buildings, too, have reached a stage where their general layout and many details of their construction can be discerned.

At the back of the station will be a large concourse, roofed over by an arch springing from buttresses on the main building. This will serve as a well-lit sheltered promenade for those awaiting trains or their friends. Beyond this concourse there will be a roofed luggage-trucking platform where luggage may be taken to any of the new platforms without impeding the movement of passengers. On the Waterloo Quay side of the station there will be a deep covered traffic bay where motor vehicles may back in to the luggage platform. A number of old buildings remain to be demolished along the Waterloo Quay side of the railway property, between that quay and the most eastern platform. This piece of ground will be retained as a wide tar-sealed roadway, and here will be the taxi stand, within easy reach of the passenger platforms. The close proximity of the steamer express wharf and its ready accessibility from the new station will be a pleasant change to inter-island passengers.

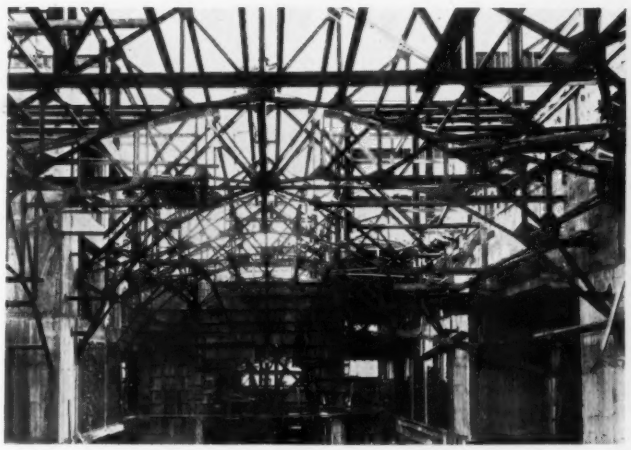
The new platforms are solidly constructed to a design which has been very favourably commented upon by overseas engineers. Steel moulds, polished and oiled to prevent the concrete sticking to them, are used to give a smart profile to the outer surface of the reinforced concrete face walls, the space between them being filled with shingle and gravel, which later will have a sealed surface. The platforms will be covered from the weather by cantilever

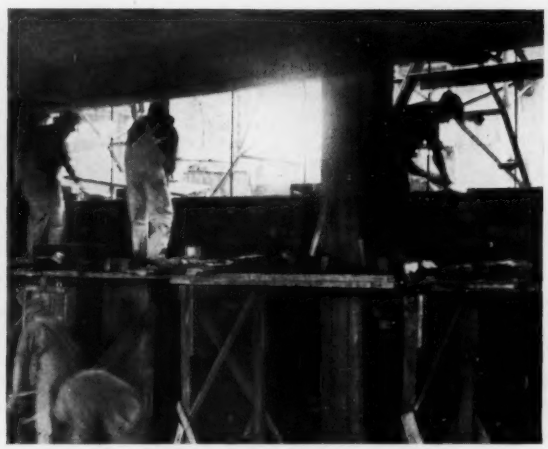


Above: Existing Lambton and Thorndon stations and various yards. Below: New central station and remodelled yards



Main south-west frontage with portico facing Bunny Street. The open space in the foreground will form the principal roadway approach





Left: Steel arched roof trusses of the booking hall. Right: The latest type of reinforced earthquake-resisting brickwork, with $\frac{5}{8}$-in. Chromador steel reinforcing rods, forming a panel in the framework of concrete-encased steel girders

General view of main building looking south, showing concrete-encased steel framework, with circulating area being constructed in the centre, and the new platforms on the left. The present Lambton station will be noted in the foreground

WELLINGTON NEW STATION, NEW ZEALAND

XUM

Y-section roofing, supported by hollow columns through which the rain water will find its way to the storm sewers. The main platforms will be wider than the others, and for these there will be two rows of roof-columns instead of one. Robertson's Protected Metal Sheeting (produced by H. H. Robertson and Company) will be used for the platform shelters.

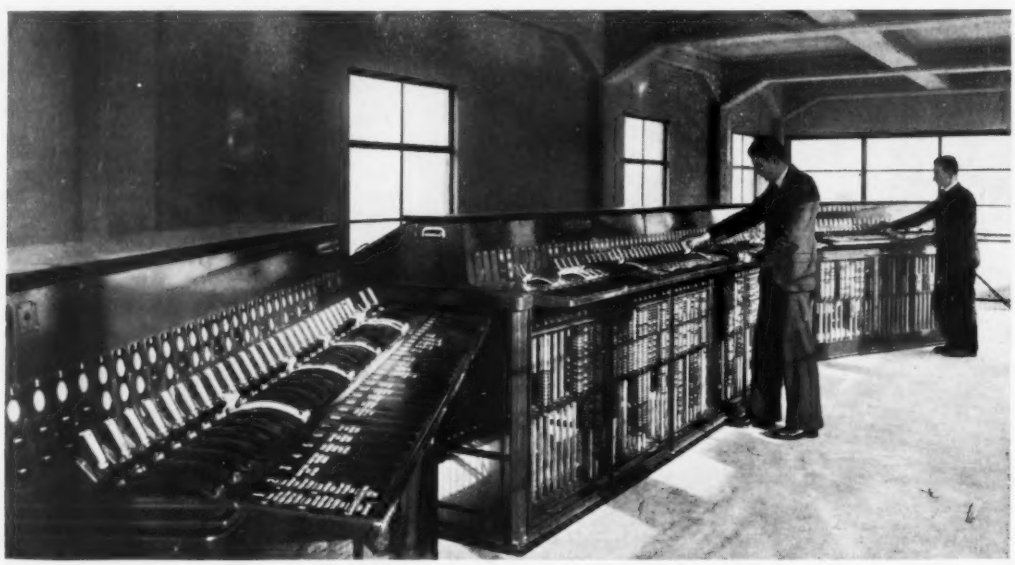
The most conspicuous and extensive part of the new yard that has so far been laid is the goods grid passing diagonally west of the goods shed: it will eventually be twice its present length. The connections now in use between it and the rest of the yard will be taken up later on. Provision has also been made for connections from the goods sidings to the waterfront, along the new wharf frontage, which extends to the floating dock. When the yard is complete there will be two main passenger tracks on the west side, and one main goods running line. Between these and the goods connections will run the passenger sidings, and between the passenger and goods shed sidings are several spaces which will be utilised for various buildings.

The main lines out of the yard will run in a gentle curve from beyond the platforms, and will be approximately parallel to Thorndon Quay, passing through what is now Thorndon station, and the present coaling yard. Before reaching the oil stores, the main goods line joins the main passenger lines, and only two lines laid with heavy rail continue another hundred yards past the oil stores to the junction of the Wairarapa and North Island main trunk lines. Thenceforward there is a double track up the gradient to the tunnels laid in continuous welded lengths of 100-lb. rail. In a central position in the yard is the 70-ft. turntable, a size demanded by the modern K-class engine. This will be worked by an electric motor.

The most notable buildings in the yard, apart from the new station, will be the locomotive and running repair sheds. These will cover an acre and a quarter of ground, and each of the steam locomotive roads will be 220 ft. long. The roof will be fitted with special smoke chutes and stacks. Separate accommodation will be provided for steam and electric locomotives, and on the eastern side of the building will be the repair shops. As the reclamation has not yet fully consolidated, timber piles, obtained from the department's own plantations in the South Island, have been driven to carry the building, and the ash and inspection pits. Running accommodation for the locomotive men is being provided in a special building close at hand.

Another building which is in course of erection and which will soon be finished contains the accommodation for the yard staff. There is a well-lit dining-room, a drying-room, and other accommodation. The tower above it will be occupied by the yard foreman who is given a good outlook over practically the whole of the yard. Provision for coaling is made by an elevating incline in another part of the yard, the trucks being hauled up by cable. The preparation of dry sand for locomotives is carried out at another spot, the sand being dropped from bins.

A specimen of the type of reinforced earthquake-resisting brickwork used for buildings in the new station premises for the first time in New Zealand, may be seen in one of the illustrations. The wall shown is 14 in. thick and is reinforced with $\frac{5}{8}$-in. Chromador steel rods. These rods are secured to concrete-encased steel girders top and bottom, and specially-moulded slotted bricks are fitted round them, the interstices around them afterwards being filled with cement mortar. The brickwork is specially bonded to resist the great lateral stresses set up by earthquake shocks.



Three-section all-electric interlocking frame in new reinforced-concrete signal cabin

Signalling

A complete and up-to-date all-electric signalling installation is also being provided. The main interlocking frame, which we illustrate, has been supplied by the Westinghouse Brake & Signal Co. Ltd. for the new cabin. As will be noted, the frame is arranged in three sections, the two outer ones being set at an angle to the middle section to facilitate operation. All locking between levers is carried out electrically, a.c. lock magnets being used. The frame is enclosed in sheet metal casing and includes all the necessary operation and selection contacts, signal and point indications on the indication panel mounted behind the levers.

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NEW FURNACE AND MACHINE INSTALLATIONS AT CREWE WORKS

Alterations and additions have been made to the plant for heat treating locomotive parts, plate flanging, and other operations in these works

Heat treatment furnaces—rear view, showing unit gas machines

ON pages 1032-36 of our issue of May 24 there appeared an illustrated article dealing with some of the new machine tools at the Crewe works of the London Midland & Scottish Railway. The improvements in output and other directions thereby effected have been furthered by additions to the plant for heat treating locomotive parts and the flanging of boiler and other plates, and similar operations.

An outstanding feature of this new development is the installation of two coal-fired furnaces for heat treating locomotive connecting and coupling rods, axles, link motion and other parts. These furnaces, manufactured

Front view showing charger in position

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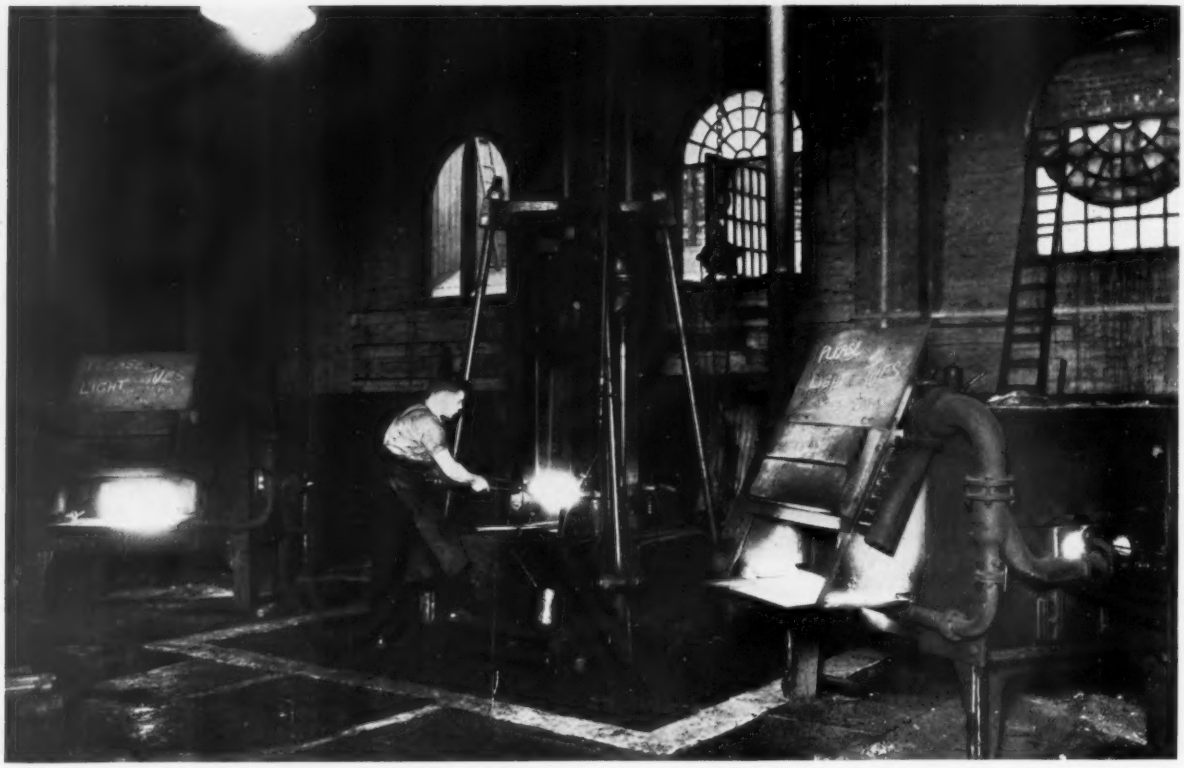


Drop hammer served by oil-fired furnaces

by the Incandescent Heat Co. Ltd. of Birmingham, each measure 15 ft. × 10 ft., and are 2 ft. high to the spring of the arch. The furnaces are fired by the same firm's automatic gas machines burning bituminous coal, and each of these machines is complete with half-ton hopper. The temperatures range from 550°-1,000° C. as required. The locomotive parts are conveyed to and from the furnaces at ground level by means of a platform trolley running on a prepared track, whilst lifting operations are effected by a 2-ton overhead electric travelling crane supplied by S. H. Heywood & Co. Ltd. of Manchester. The charging of the furnaces is effected by an electrically operated charging machine of the same manufacture, mounted upon the mobile platform above referred to.

The method of operating the unit automatic gas machine is briefly as follows: fuel is conveyed into the hopper and mechanically conveyed by the overfeed system to the fuel bed by means of a heavy-type spiral screw fitted with indexed automatic variable speed control. The grate is of the inclined suspended rocking type, the action of which ensures definite and positive agitation of the fuel bed at all capacities. The refractory lining of the fuel chamber is constructed within a water-cooled casing and maintained at a temperature which positively eliminates adhesion of the clinker and the necessity for manual attention, hand poking, &c. The mechanically-operated plough is synchronised with the fuel feed, and is fitted with indexed ash percentage control, so that the rate of ash discharge may be calibrated to suit fuels of varying ash content. This machine is fitted with electric motor, switchgear, and blower, and is complete with automatic control for supplying the necessary air volume for the gasification rate desired. The controls may be set as readily and with the same precision as the controls of gas or oil burners. The resultant gas or heat delivered from the machine is maintained with absolute constancy and uniformity for short or extended periods without further attention. Particulars of the treatment in the furnaces are as follow:—

Normalising.—Components maintained at 1,000° C. for 5 hr.
Quenching.—Components maintained at 850° C. for 1 hr. and then quenched in oil.
Tempering.—Components maintained at 660°–670° for 3 hr. and then quenched in oil.

Drop Hammer and Furnace Installation

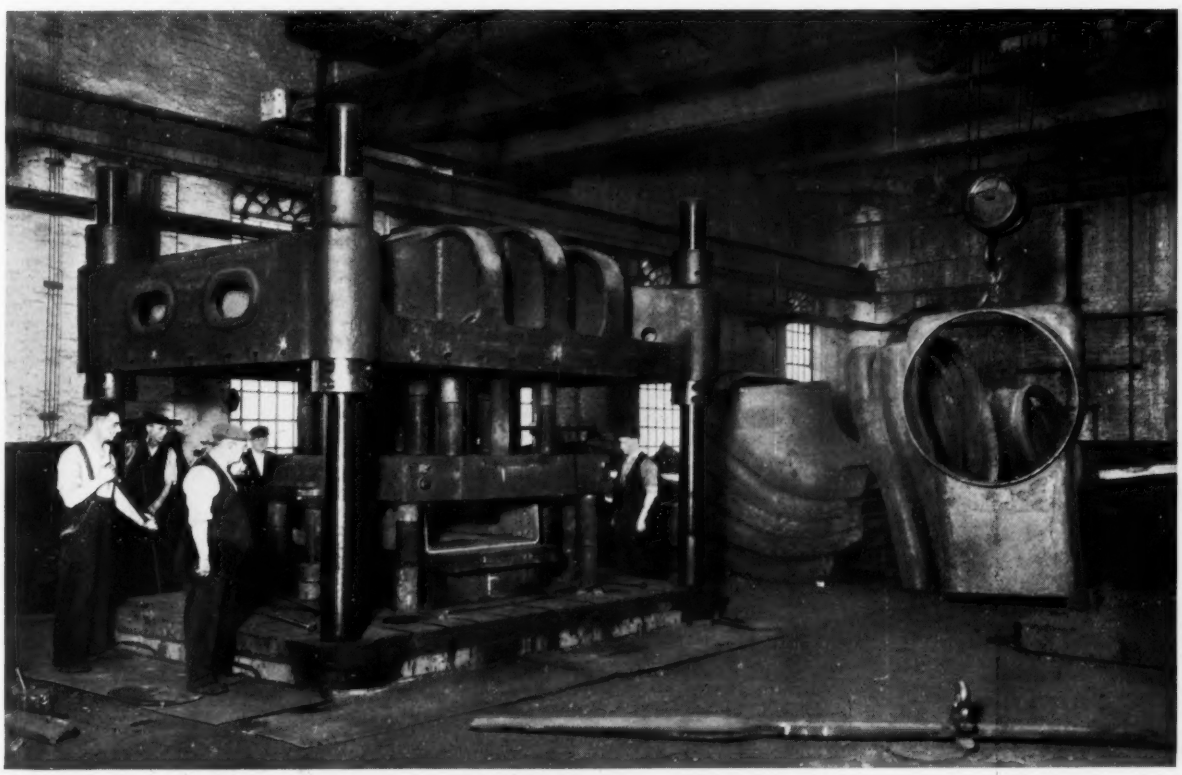
In another part of the works there has been installed a plant consisting of a drop hammer served by two conveniently placed furnaces. The hammer is known as the Bêché and, at the Crewe works, is of the 15-cwt. type. It is handled in this country by Leo. C. Steinle Limited and is served by two No. 4 oil-fired furnaces supplied by B. & S. Massey Limited, Manchester. The construction of the hammer is low and compact and it has been designed to withstand continuously even the most violent vibrations and oscillations without damage. The machine is supplied with hand lever and foot gear, and the tup is moved downwards with force, this action being repeated when blows in series are required. The tup can be raised to any desired height, and the force of the blow regulated with ease. Special attention has been given to the design of the piston rods and the buffers used therewith. Rubber buffers are inserted between the tup and the piston rods for the purpose of eliminating head shocks, and in consequence of the elasticity of the rubber, the piston rod is quite unaffected by lateral displacements of the tup when the tup guides are of slack fit; as, in addition to this, the whole stuffing box is movable laterally, the piston rod is in no way subject to bending strains. Breakage of piston rods in these hammers is claimed to

be virtually unknown. The short vibrations downwards of the anvil block after the blow has been delivered are isolated from the cylinders by means of springs. The cylinders are fitted in the anvil block at the top and bottom ends, and the driving gear and slide valves are lubricated by a hand-actuated pump. The total weight of the anvil block is approximately 25 times that of the tup. The blow effect of these drop hammers is approximately 1,600 ft.-lb. per 220 lb. of falling weight.

The oil-fired furnaces used in conjunction with the hammer are simple and robust in construction, and the burner, having no moving parts, requires very little attention. Independent regulation of the air and oil supplies, combined with efficient atomisation, enables smokeless combustion to be effected, whilst the low blast pressure which can be used secures economy and air consumption, and makes it possible to use low-pressure fans which are cheaper in upkeep. The low air pressure, moreover, reduces the amount of heat thrown out from the furnace, and a firebrick screen is so arranged in conjunction with the front blast that all the hot gases pass up between it and the furnace. There is, therefore, an actual intake of fresh air under the screen. The illustration shows quite well to what a large extent the furnace man is protected from the heat of the furnace by the firebrick screen.

Both the furnaces are fitted with air and oil preheaters, which assist considerably in effecting economy. It is stated that at a cost of only one tenth of a penny the oil preheater halves the time for starting up, whilst the air preheater adds very considerably to the efficiency and economy of the furnace. A filter is embodied in the burner and ensures clean oil, thereby also maintaining a regular flow and steady combustion. Each of the furnaces has a hearth measuring 31½ in. × 22½ in. and the oil and air consumptions under normal conditions are approximately 4 gallons an hour and 300 cu. ft. of free air a minute respectively.

Although not among the latest installations at the Crewe works, the hydraulic flanging press illustrated is of a powerful type, and is used for flanging locomotive firebox, front, and boiler tube plates. It was supplied by the firm of Hugh Smith & Co. (Possil) Ltd. of Glasgow. The main ram has a power of 700 tons by 3 ft. 9 in. stroke and is fitted with an internal ram having a power of 200 tons by 7 ft. 6 in. stroke. The press is 11 ft. 6 in. × 8 ft. 6 in. clear width between the columns and has a clearance of 8 ft. between the tables, adjustable to 3 ft. 6 in. It is fitted with four hydraulic vicing cylinders and rams, adjustable in and out radially; all the main castings and cylinders are of steel. The press is fitted with the maker's power saving arrangement, which is entirely automatic and not dependent on the care of the workman. The working pressure is 2,000 lb. per sq. in. The main power is eliminated when setting flanging blocks and this excludes the possibility of the press being charged with full power when the men are engaged between the tables for this purpose. Accidents of the kind referred to are entirely obviated by this new device. In the illustration a steel tube plate for an 0-6-0 superheater freight boiler is seen in the press, this being produced from flat plate ⅛ in. thick treated to a temperature of 1,000° C. at one stroke, whilst in the background there are seen a number of steel saddle plates for the new 4-6-2 type passenger engines now in course of construction in the works, and in addition some firebox plates for the same flanging. The press is served by a plate heating furnace of the 4 oil-burner type, measuring 12 ft. 6 in. × 10 ft. 6 in. × 2 ft. 9 in. door opening; this is supplied by Manchester Furnaces Limited, Manchester.



700-ton hydraulic press, flanging steel tubeplate

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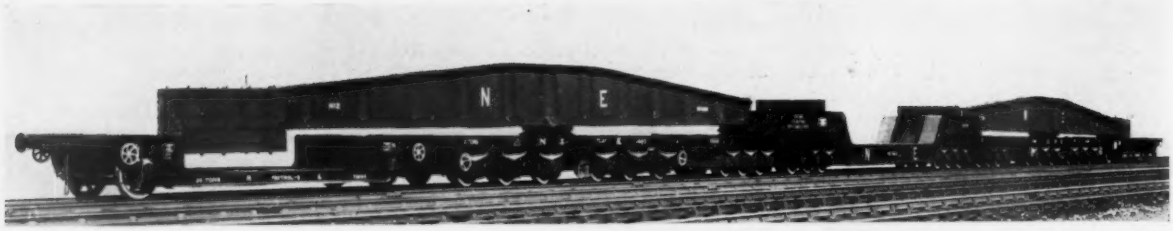

British Freight Rolling Stock

III.—L.N.E.R. Exceptional load equipment and containers

For the conveyance of concentrated loads, such as electric stators and ingots, the L.N.E.R. uses a 150-ton well trolley wagon set. The complete set consists of 110-ton well trolley wagon, two 60-ton flat wagons and two 20-ton trolley wagons. The 110-ton well trolley wagon itself is capable of carrying a self-contained load of 150 tons, but the cantilever arrangement is necessary to spread the weight over the permanent way

The containers illustrated are: Type AX (also known as Drikold), a heavily insulated pattern with top doors only for conveying Drikold (solid carbon dioxide); and a Type BK household furniture container. This is constructed of blockboard and equipped with lathes inside to enable the furniture to be adequately secured

RAILWAY NEWS SECTION

PERSONAL

Sir John Pybus, Bt., C.B.E., M.P., M.I.E.E., Minister of Transport, 1931-33, whose death we recorded in our issue of October 25, was born at

Photo] [*Vandyk*

The late Sir John Pybus, Bt., C.B.E., M.P., M.I.E.E.
Minister of Transport, 1931-33

Hull in 1880. In 1917 he was created a C.B.E. for his services to the Ministry of Munitions, and represented the Harwich Division of Essex as a Liberal—and later National Liberal—Member in Parliament from 1929 onwards. He was appointed Minister of Transport under the first National Government in September, 1931, and retained that position when the late National Government came into office three months later. Sir John was Vice-President of the B.E.A.M.A., Chairman of the Power & Traction Finance Co. Ltd., joint Deputy Chairman of the Phœnix Assurance Co. Ltd., and a Director of Associated Portland Cement Manufacturers Limited, British Portland Cement Manufacturers Limited, Sudan Light & Power Co. Ltd., The Times Publishing Co. Ltd., Willans & Robinson Limited, English Electric Company of Canada, and other companies. Among the many Government commissions and committees upon which he served were: the Royal Commission on the Civil Service, the Development (Public Utility) Advisory Committee, Committee of Education and Salesmanship, Committee of Industry and Trade, and the Unemployment Grants Committee for ten years.

The cremation took place at Golders Green on Saturday, and at the funeral service there were present, in addition to the family mourners: Sir Charles Barrie (Director, L.N.E.R.), and Mr. J. N. Stephens (representing Sir Felix Pole). A memorial service was also held for Sir John at St. Bride's, Fleet Street, on Tuesday, at which were represented a large number of commercial and other interests with which he was associated.

Mr. H. N. Colan, Agent of the Madras & Southern Mahratta Railway, has been elected President of the Indian Railway Conference Association for the year 1936-37.

We regret to record the death, on October 30, of Mr. Herbert Marriott, C.B.E., who retired from the position of Assistant to the General Manager, L.M.S.R., in 1924, and was, prior to the amalgamations, Chief Goods Manager, Lancashire & Yorkshire Railway. He was also well known in Government and League of Nations circles.

Mr. W. J. Clayton, F.A.I., who, as recorded in our issue of October 25, is retiring at the end of the year, from the position of Estate Agent to the Southern Railway after 54 years' service, entered the service of the South Eastern Railway in 1881, and was appointed Estate Agent to that company in 1905. Upon the grouping of the southern lines in 1923, Mr. Clayton became Estate Agent, Eastern Division, Southern Railway, and was appointed Estate Agent of the Southern Railway in 1932.

Sir Archibald Gilbey Gold, late Chairman of Prichett & Gold and E.P.S. Co. Ltd., whose death we announced in our issue of August 30, left estate valued at £44,377 (£41,621 net).

Mr. S. F. A. Morris, whose retirement from the position of Divisional Superintendent, Gloucester, G.W.R., we recorded in our issue of June 7, was the recipient of a presentation, on October 22, subscribed to by members of all departments, and made to him on their behalf by Mr. L. J. A. Callaway, District Goods Manager. It took the form of a wireless set and a dressing-table set for Mrs. Morris. Mr. Callaway and others warmly testified to Mr. Morris's popularity, efficiency and justice as a disciplinarian. Returning thanks, Mr. Morris emphasised that he had always relied—successfully and happily—upon his staff for that true spirit of co-operation which was so essential to smooth and efficient working.

Sir Murrough J. Wilson, K.B.E., presided at the fifteenth annual masonic reunion dinner of members of the staff of the London & North Eastern Railway Company, which was held at the Hotel Great Central, on Saturday, October 26. Mr. William Whitelaw presided last year, and Sir Charles Batho in 1933.

Mr. W. J. Clayton,
Estate Agent, Southern Railway, 1932-35

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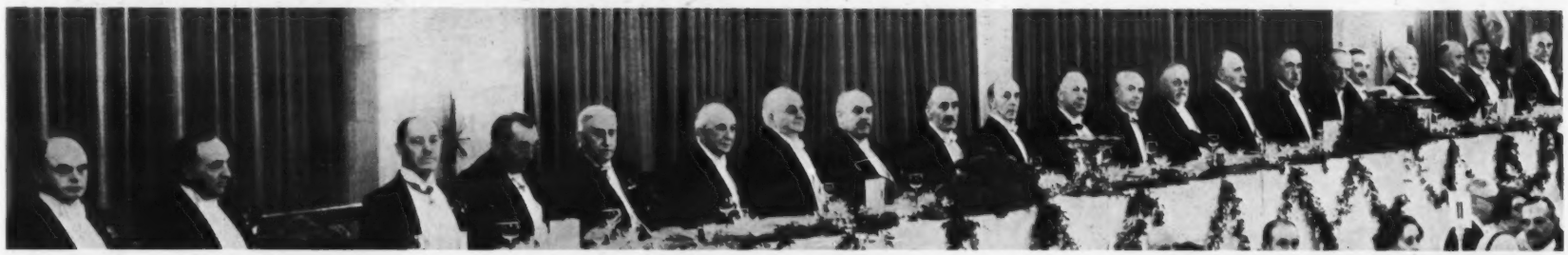
The G.W.R. Centenary Banquet

Held on Wednesday, at Grosvenor House, London

[*Photos: Rawood*



The Great Western Railway Centenary Banquet

H.R.H. The Prince of Wales was the guest of the Great Western Railway at the company's Centenary Banquet held at Grosvenor House, Park Lane, on Wednesday. The Rt. Hon. Sir Robert Horne, Chairman of the company, presided. The gathering totalled over a thousand at this culminating ceremony of the railway's centenary celebrations.

The following were among the principal guests :—

H.R.H. the Prince of Wales ; the Rt. Hon. Lord Aberconway ; the Rt. Hon. C. Addison ; Sir Hugh P. Allen ; the Rt. Hon. L. S. Amery and Mrs. Amery ; Major the Hon. J. J. Astor and Lady Violet Astor ; Mr. S. J. Aubrey ; Sir Herbert Austin ; Mrs. Baldwin ; Sir Percy and Lady Bates ; Sir John and Lady Beale ; Sir George Beharrell ; Sir J. Gomer and Lady Berry ; the Rt. Hon. Lord Blanesburgh ; the Rt. Hon. R. C. Bourne ; Sir T. Vansittart Bowater, Bt. ; Sir Joseph and Lady Burn ; Sir John and Lady Cadman ; the Rt. Hon. E. C. G. Cadogan ; Sir Archibald H. Campbell ; the Rt. Hon. Lord Camrose ; Mr. R. Carpmael ; Lt.-Col. Sir Gordon Carter ; the Rt. Hon. (Christine) Viscountess Churchill ; Mr. C. B. Collett ; Mr. and Mrs. A. C. Cookson ; Mr. and Mrs. R. Cope ; the Rt. Hon. Patricia Countess of Cottenham ; Sir Herbert Creedy ; Mr. and Mrs. C. R. Dashwood ; Mr. and Mrs. F. R. E. Davis ; Dr. Julius Dorpmüller ; Mr. J. W. Dulanty ; the Rt. Hon. Lord and Lady Dulverton ; the Rt. Hon. the Earl of Dunmore ; Sir R. Francis Dunnell, Bt. ; the Rt. Hon. the Earl and Countess of Dunraven ; the Rt. Hon. Lord and Lady Ebbisham ; Lt.-Gen. Sir Hugh J. Elles ; the Rt. Hon. Lord Essendon ; the Hon. G. Howard and Mrs. Ferguson ; the Rt. Hon. Lord Glanely ; Sir Robert and Lady Gooch ; the Rt. Hon. Viscount Goschen ; the Rt. Hon. Lord and Lady Greenwood ; Col. the Rt. Hon. John Gretton ; the Hon. Mrs. Ronald Greville ; Admiral Sir Lionel Halsey ; Mr. Charles J. Hambro ; Mr. E. L. Hann ; Sir Harold and Lady Hartley ; Mr. E. Holland-Martin ; Mr. and Mrs. Robert Holland-Martin ; the Rt. Hon. Sir Robert Horne ; Sir W. Edgar and Lady Horne ; Mr. A. G. Hubbard ; Sir Cyril and Lady Hurcomb ; the Rt. Hon. Lord Iliffe ; Sir Henry and Lady Mather Jackson ; Mr. C. M. Jacobs, ; Sir William F. Jury ; Mr. E. Kaan ; Dr. Werner Kieschke ; Sir Stephen H. M. Killik ; the Hon. Sir Wilfrid Lewis ; Mr. and Mrs. Cyril E. Lloyd ; Mr. and Mrs. G. F. Luttrell ; Lt.-Gen. Sir George MacDonogh ; Sir Harry and Lady McGowan ; the Rt. Hon. Reginald McKenna ; the Rt. Hon. Lord Macmillan ; Mr. H. J. Maggs (Lord Mayor of Bristol) ; the Rt. Hon. Lord Marshall ; Mr. A. Maynard ; the Rt. Hon. Lord Mildmay of Flete ; Field-Marshal the Rt. Hon. Lord Milne ; Sir James and Lady Milne ; Sir Harold Morris ; Lt. Col. A. H. L. Mount ; the Rt. Hon. the Earl of Mount Edgcumbe ; Mr. and Mrs. S. M. L. O'Keefe ; Mr. and Mrs. C. S. Page ; the Rt. Hon. Lord and Lady Palmer ; Mr. J. W. Beaumont Pease ; Mr. and Mrs. F. Pick ; the Rt. Hon. Lord and Lady Plender ; the Rt. Hon. Lord and Lady Portal ; the Rt. Hon. Earl and Countess Poulett ; Sir William Prescott ; Sir Walter Preston ; Sir Arthur Pugh ; Sir Alfred and Lady Read ; the Rt. Hon. Lord Ritchie ; Sir Henry and Lady Robertson ; the Rt. Hon. Sir Malcolm and Lady Robertson ; the Rt. Hon. Lord Rockley ; Mr. E. W. Rogers (Lord Mayor of Plymouth) ; Mr. and Mrs. Glynne Roberts ; Mr. and Mrs. F. W. Showers ; Sir Josiah and Lady Stamp ; Sir Kynaston Studd, Bt. ; Mr. F. A. Szarvasy ; the Hon. Sir Francis Taylor ; Sir W. James and Lady Thomas ; the Rt. Hon. Viscount Tredegar ; Col. A. H. C. Trench ; the Hon. Mrs. Tryon ; the Rt. Hon. Viscount Wakefield ; Sir Herbert and Lady Walker ; Sir Ralph and Lady Wedgwood ; the Rt. Hon. Lord Weir ; Sir Evan Williams ; Sir Watkin Williams-Wynn ; Col. Sir Chas. and Lady Wright.

Sir Robert Horne proposed the toasts of " The King," and of " the Queen, the Prince of Wales, and the other Members of the Royal Family."

The Prince's Speech

H.R.H. the Prince of Wales, in proposing the toast of " The Great Western Railway Company," said he considered it a great privilege to have been invited to propose that very important toast. They had travelled a long way since the audacious design of an iron road from London to Bristol, along which steam locomotives should carry not only goods but even passengers, was embodied in an Act of Parliament. The railroad train, with its smoke and rattle, with its almost incredible speed, then seemed like a monster roaring through the countryside on which men rode at their own peril, and at the cost of the old-world life as our ancestors had known and loved it for centuries; hence the opposition aroused by this absolutely new departure. It was said that the railroad would bring the filth and squalor of manufacturing towns to peaceful rural districts, and would endanger crops and private property. Worst of all, a horde of urban radicals and dissenters would be loosed upon the countryside by this new contraption, to corrupt it with their subversive doctrines. Fox hunting would be imperilled, public school boys led astray, and passengers shaken to death in its carriages, and all for the benefit of an engineer and his small covey of friends.

The Prince recalled that when his great-grandmother, Queen Victoria, made her first journey by train from Windsor to Paddington, wide circles in Britain sustained a very serious shock, and men and women shook their heads far more than they did when some years ago he himself had begun to use the aeroplane as a more speedy and convenient vehicle. Such were the resistances of the old world to what was, without doubt, the prime agent in creating the new, but the steam horse ploughed its way through them all, and nothing could stop the march of human destiny. To-night they were meeting in a terrific world, where everything was increasing in size and speed, whirling them along to greater triumphs, and perhaps greater difficulties than any known before.

It was important, said the Prince, to notice the ways in which the harnessing of steam had benefited the world, and this country in particular. When the pioneers of the Great Western Railway were completing the track to Bristol, England was, in the words of Disraeli, a land for the few, and for the very few. Now it had been made a land for the many, and the nation dreamed and strove for the days when it should be a land for all.

From its earliest days the Great Western Railway had been a link between the Sovereign and the Government. The Prince referred to the constant coming and going of distinguished personages, prime ministers, would-be prime ministers, members of the Cabinet, and others between London and Windsor in the days of Queen Victoria. " Indeed," he said, " your company, your great company, deserves its name of ' the Royal Road ' if only for the fact that it was on your wheels that Queen Victoria first experienced railroad travel, and because it was on your lines that she was borne on her last journey home."

" Ladies and gentlemen," the Prince continued, " I have a personal association with the Great Western Railway because it serves the West of England. Your tracks pass through the counties of Somerset, Devon, and Cornwall, where, as Duke of Cornwall, I have many tenants dependent on your services. You carry their produce from the West Country to their chief market, and, which is as important, you bring them holiday makers and tourists who in the summer season rejoice to be able to visit some of the most beautiful parts of the British Isles.

" So it is not only as a traveller, but as a landowner, and indeed a customer of the line, that I have the pleasure of accepting your hospitality tonight. I wish, therefore, to pay my tribute to all that the Great Western Railway has done for the West Country during the century of its existence. Speed, comfort, convenience, flexibility, have all been keynotes of your administration. It can never be said that the Great Western Railway has not moved with the times. It is a fact that your company was the first railway company to establish, a few years ago, a regular daily air service. You have held the balance fairly between competing interests. You have discharged your duty to the public with loyalty. You are a venerable, honourable, institution in our native land."

It was not his intention, the Prince continued, to exalt the Great Western above all other railways, but this was the company's night out, and it was entitled to have its own trumpet blown, and he was very happy to have the opportunity of giving it a hearty and resounding blast.

The Prince then referred to the way in which the Great Western Railway had preserved the continuity of its traditions, and the fact that so many families had remained in its employment for generation after generation. For many years the company had paid special attention to the welfare of its staff, and to the preservation of the good will of all ranks and grades of its employees, of whom he was glad to see so many present that evening. The company offered not only employment but a career to those who served it well. Its staff had established a very high standard of efficiency and courtesy.

Many difficulties and anxieties had beset the administration of our rail-

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ways in the last few years, and new problems lay ahead. If those connected with the administration of that great company continued worthily to uphold the traditions of their predecessors, they would surmount those difficulties and long continue to discharge a public trust with honour to themselves and with great benefit to their fellow countrymen.

The Prince coupled with the toast the name of Sir Robert Horne. "I know," he said, "that he is so well known to you that he needs no introduction from myself, and may I say this, that I first had the pleasure of meeting him and making his acquaintance when I was very new to this kind of game. It was just after the war when he was in the Cabinet; we sat next to each other on several occasions, and he was always kind to me, and I might say that he gave me an almost fatherly confidence at this time. He is one of the most important public men in this country, and I am very proud to be especially his guest."

Sir Robert Horne's Reply

Sir Robert Horne, in his response, said that he felt the greatest possible diffidence in replying to the witty and charming speech that had just been delivered. The Prince of Wales, he said, had blown them a blast from a great trumpet, and he was sorry that he could reply only with a very feeble horn. His Royal Highness had conferred a great honour upon the company and placed it under a lasting debt of obligation.

The Prince had spoken of the success and reputation which the Great Western Railway had achieved, and the company was very proud of these results, which, it admitted, were mainly the products of past administration. It was its good fortune to have created a kind of family affection among those whom it served, and that affection had often been beneficial by reason of the spirit of correction it engendered.

The presence of the Prince of Wales recalled the many journeys between Windsor and Paddington by members of the Royal House and, in particular, the fact that the first—and, indeed, the last journey which Queen Victoria ever made by rail was upon that route.

The first was nearly sixty years before, when Her Majesty travelled in the first eight-wheeled railway coach in existence, and recorded at the time that the journey had been accomplished "free from dust and crowd and heat," and that she was quite charmed with it. With their customary curiosity, Members of the House of Commons did not fail to take notice of this journey. A question was asked in the House by an honourable Member which seemed to imply that Her Majesty's person ought not to be subjected to the risks of railway travel; and an answer was given stating that two carriages had been interposed between the engine and the one occupied by the Queen, in order to obviate risk of collision. Doubtless it was this reply which inspired a well-known Bishop to remark upon a certain occasion, that he had a profound belief in Divine Providence Who over-ruled all things to His purposes, but he was always careful never to travel in the compartment next the engine. Upon the occasion of that momentous journey, however, said Sir Robert, the Queen's safety was ensured by other more effective aids. Gooch himself—one of the greatest designers of railway locomotives of all time—drove the engine, and the illustrious Brunel was in the cabin.

Referring to the question asked in the House of Commons regarding the Queen's first journey, Sir Robert said that it was symptomatic of the contemporary mistrust of railways in general. A certain gentleman called Cort obtained considerable support, both moral and material, for views which he put forward in a book* called "Rail-road Impositions Detected." One of his most ardent coadjutors and handsomest subscribers was the Provost of Eton, who feared the effect upon his pupils of a railway which might lure them to the Lights of London. Like Shakespeare, he must have thought "how oft the sight of means to do ill deeds makes ill deeds done." And doubtless Brunel's 7-ft. gauge suggested poignantly to his apprehensive mind the broad path leading to destruction. He did not intend, however, to beg for sympathy for the members of the Great Western board on the grounds of sleepless nights over the demoralisation of Eton.

Cort, however, was a much more eloquent opponent of the railway than even the Provost of Eton. With the prejudices which he entertained, it was not unnatural that he attributed these railway projects to "the speculation of engineers, attorneys, and capitalists"; and he displayed a lively fancy in predicting that "people would be smothered in tunnels, while those that escaped suffocation would be burned." But he reached his most exuberant pitch in the following passage: "Though the Great Western probably reach as far as Bath from Bristol, after having like a mole explored its way through tunnels long and deep, the shareholders who travel by it will be so deadly sick, what with foul air, smoke, and sulphur, that the very mention of a railway will be worse than ipecacuanha."

In looking back to the year 1835 a vast difference in mental outlook was evident as compared with 1935. A hundred years ago people were apprehensive and fearful of the results upon practical life of scientific ideas. Today, they were impatient of any seeming delay in applying them to conditions however refractory or unsuitable. Today every scientific theory was being turned to practical account. The most startling feature of the present time was, in fact, the rapidity with which practical invention had trodden on the heels of theory. All the more therefore must they acclaim the pioneers of a hundred years ago for the courage with which they countered the scepticism of their time.

Today the company had expanded to three hundred times its original size and had accumulated many outside interests. But the spirit of the railway was not changed. It was, he hoped, as eager for new forms of reasonable adventure where these existed. It was ready, within its resources, to test new devices; to adopt new methods; to exploit the sea and the road and the air, as well as the permanent way of the rail. For inspiration, he was glad to recall that, amid all the changes that had taken place, the company's identity remained; its individuality was preserved; its vigour was undiminished; its traditions and reputation were high; and its place—pray heaven—in the loyalty of the people whom it served securely established. He thanked the gathering in the name of his colleagues and himself for the enthusiastic good wishes with which it had helped to launch the company's argosy upon the seas of its second century.

Other Speeches

The Rt. Hon. Lord Palmer, Deputy Chairman, proposing the toast of "The Guests," said that the present occasion would always be remembered as a milestone in the company's history. He knew that many people had a reserved compartment in their hearts for the Great Western Railway, and he hoped the company would always retain that compartment. He was proud of his long association with the undertaking, during which he had known three former chairmen, among them, Mr. Alfred Baldwin, the father of Mr. Stanley Baldwin. Mr. Stanley Baldwin himself had come to the board for a short period after the death of his father, and the fact that he had been enticed away to the political arena was to be accounted the company's loss, if the country's gain. Had it not been for the approaching General Election, Mr. Baldwin would have been there that night. As it was, he welcomed Mrs. Stanley Baldwin in his place.

Mrs. Stanley Baldwin responded to the toast, and said that her husband still entertained the deepest regard for the company. An old Great Western key which had belonged to his father always travelled in a special compartment of his bag, along with important papers and precious pipes. She appreciated the honour conferred upon her in the invitation to reply for the guests, particularly as it had come from so important a personage as the Chairman himself. She remembered an occasion very long ago when she tried to impress upon her family the great dignity to which their grandfather had been raised by his appointment as Chairman of the company. She was

* We refer to this in an editorial article on page 705.—Ed. *R.G.*

interrupted by a small voice inquiring whether the Chairman was the personage who carried their luggage when they went to the seaside, whereupon another voice chimed in with the remark: " no, stupid, he's the man who blows the whistle."

Lord Macmillan also responded to the toast, saying that his services to the company had been mainly in the direction of helping it to go off the rails. With his help it had extended its operations to the roads, and even to the air. The only avenue unexplored would seem to be the submarine service, and it even encroached upon that by means of the Severn Tunnel. He could, perhaps, claim to be Sir Robert Horne's oldest friend. They had fought many cases in the old Parliament House in Edinburgh, when Sir Robert had appeared for the traders and he himself for the railway company. Today, the poacher had turned gamekeeper. In conclusion, Lord Macmillan described the hospitality of the Great Western Railway as still being on the broad gauge, and offered his best wishes for its success in the century upon which it had just embarked.

The Centenary Film

After the speeches, the Great Western Centenary film was shown. This production, to which we have already referred in our issue of September 6, 1935, is entitled " The Romance of a Railway," and gives an impression of the company's development from the original meeting of merchants at Bristol in 1833, up to the present day. A sound accompaniment of music specially written by Mr. Leslie Bridgewater, adds to the effectiveness of the scenes, particularly those portraying the associations which the name " Great Western " has acquired in its long history. Scenes in the West Country, views of architecture selected from the many notable examples in the towns and cities served by the railway, and impressions of the company's activities at its ports, lead up to a finale showing the construction of a locomotive at Swindon. The historical scenes introduce the characters of Brunel and Gooch, and the opening of the railway to Maidenhead, after which glimpses of the conversion from broad to narrow gauge provide a link with the modern episodes.

Forthcoming Meetings

Nov. 5 (*Tues.*).—**Arica & Tacna Railway Co. Ltd.** (Ordinary General), Dashwood House, E.C.2, at 12 noon.

Nov. 6 (*Wed.*).—**Buenos Ayres Western Railway Limited** (Ordinary General), River Plate House, E.C., at 12 noon.

Nov. 6 (*Wed.*).—**Bahia Blanca & North Western Railway Co. Ltd.** (Ordinary General), River Plate House, Finsbury Circus, E.C., at 2.15 p.m.

Nov. 12. (*Tues.*)—**Bengal Dooars Railway Co. Ltd.** (Ordinary General), Gresham House, Old Broad Street, E.C., at 2.45 p.m.

The L.N.E.R. Athletic Association (G.N. Section)

The Hon. Rupert E. Beckett presided at the thirty-eighth annual dinner and dance of the London & North Eastern Railway Athletic Association (G.N. Section), which was held on Friday, October 25, at the Great Eastern Hotel, Liverpool Street. Those present included:—

Mr. William Whitelaw, Sir Charles A. Batho, Messrs. A. J. Brickwell, A. Burton, O. H. Corble, H. R. Cripps, Major R. C. Carr, Messrs. T. F. Day, P. J. Dowsett, A. J. Grinling, R. J. M. Inglis, H. Jude, J. McLaren, G. Marshall, W. R. Mole, C. H. Newton, R. R. Petit, A. P. Ross, P. Syder, T. H. Seaton, T. Smith, J. Smart, G. A. Sawyer, C. J. Selway, J. Procter Smith, C. F. Slade, F. C. C. Stanley, C. B. Tidmarsh, J. C. L. Train, A. B. Walker, V. M. Barrington-Ward, and J. Warriner.

Mr. T. F. Day, District Goods Manager, Sheffield, in proposing the toast of " The London & North Eastern Railway," said it was an easy task, as most of those present were in the service of that great company. He referred to the consideration, help and inspiration they received from the chairman, directors and chief officers. The company was never more efficient than today and never more scientifically managed. Those who told the railways to put their house in order were very wide of the mark. Continuing, he referred to the already world famous Silver Jubilee streamline engine and train which had recently been introduced by Mr. Gresley. It was a wonderful achievement and a great advertisement for the company.

Mr. William Whitelaw, in responding, said that the London & North Eastern Railway was justly proud of its world-famous train, the Silver Jubilee, and of Mr. Gresley who had produced it. It was, however, important to point out that the engine which drew the train was a success, not because it could run at a speed of 100 m.p.h. downhill, but because it could run at 75 m.p.h. uphill. It was uphill work that counted, and their own work at present was all uphill. However, with the help of every section of the staff, and with the aid of that courage which was so essential, they would, sooner or later, reach the top of the hill. Constant courage was needed if they were at last to win through. Sometimes it required courage to stand still. Various statements had been made as to the intentions of the company, and some of them were quite wrong. It was, for instance, said that they were now going to electrify even a part of the old Great Northern Railway, but that was not wholly true. Somebody else was going to electrify it for them, and that was what they had been waiting for. If there was a great national need for something which was not going to pay, it was only reasonable that some scheme should be devised for assisting the railway company. They had waited for the right time and the right method.

Major R. C. Carr, in proposing the toast of " The Athletic Association," referred to his early association with it, and expressed his pleasure at being present again after so many years retirement from active service. Mr. Beckett, in responding, said he was pleased to see so many old Great Northern officers occupying prominent positions in the London & North Eastern Railway. Continuing, he referred to the retirement of Mr. Brickwell as Chairman of the Committee of the Athletic Association, and expressed his pleasure that they had induced Mr. Ross to succeed him. Regarding the Silver Jubilee train and its engine the *Silver Link*, really the engine was one of Mr. Gresley's Pacifics dressed in a new garb. Personally he wondered how he would look if he were dressed in a pull-over and shorts. He ventured to think he might be called the " Missing Link."

Southern Railway Pupils and Premium Apprentices

The tenth annual dinner of the Southern Railway Pupils and Premium Apprentices Association was held under the chairmanship of Mr. S. Bailey (Chairman, Ashford Branch) on October 25, at the Charing Cross Hotel. Mr. S. Bailey proposed the toast of " The Guests," and Mr. J. T. Finch responded. Mr. J. F. Baker (Ashford) proposed the toast of " The Chief Mechanical Engineer of the Southern Railway."

Mr. R. E. L. Maunsell, C.B.E., in response, referred to recent developments in locomotive design and emphasised that the steam locomotive was still holding its own. He touched also upon electric traction, with special reference to the Southern Railway's existing system of electrified lines and their probable extension. Concluding, he announced a very welcome development in the apprentice training scheme in his department under which the apprentices selected at Ashford, Lancing, and Eastleigh for drawing office training would in future also be given a period of six months training in the respective locomotive or carriage running departments.

Sir John E. Thornycroft, K.B.E., Director, Southern Railway, responding to the toast of " The Southern Railway," proposed by Mr. H. B. West (Eastleigh), referred at some length to the very great assistance which the road vehicle was giving to the railways in the development of rail-borne traffic. South Africa he quoted as an excellent example, as there road vehicles had been used extensively as feeders, often working over country without proper roads at all, enabling traffic to be developed, and sometimes profitable railways later to be laid. A party of entertainers enlivened the intervals between the speeches.

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Twelve Months' New Railways in China

It has now become our custom to review the progress made in the expansion of the railway system of China about this time of each year, and to record what new sections of line have been completed from time to time during the previous twelve months. Our last résumé of this subject was published in THE RAILWAY GAZETTE of October 12, 1934, and a map of the system brought up to that date accompanied it; the new map we now publish incorporates the additional mileage completed to the present time.

The first line now to be noted is the extension of the Lung-Hai main line to the new terminal port of Lienyunkang. This line carried 10,000 tons of exports and 2,000 tons of imports during the first month it was open, and so, though of no great length, it is of considerable importance. It was actually opened on October 1, 1934.

Then on December 17 the first section of the Hwainan Railway, in Anhwei, was completed from Lohochien to Hofei (Luchowfu). This line is important in that it taps the Hwainan coalfield. A little farther east, the first section of another new railway, the Nanking-Wuhu, was brought into use from Wuhu to Hsuanchen on November 25. There will eventually be connection between these two lines by a ferry across the Yangtze at Wuhu. About the same time too, a new mineral branch of the Tatung-Puchow Railway was completed from Taiyuan to Hsishan in Shansi.

Slightly ahead of programme, public traffic over the Weinan-Sian extension of the Lung-Hai Railway was inaugurated on December 27. It is an important 40-mile section of line giving access to the capital of Shensi. This railway is already being pushed farther westwards, and is one of the main east-to-west arteries of the country. About this time also the southern section of the Tatung-Puchow Railway was extended from Chieh Hsiu to Hwochow, a distance of 50 miles.

Another line intended mainly for the carriage of coal, and 19 miles in length, was opened between Taierchwang and Chaochwang on the Shantung-Kiangsu border, early in 1935. It is a branch of the Lung-Hai Railway. On April 21 the Nanking-Wuhu line was completed and opened for traffic. Sixty miles in length, it is an important link running parallel to the Yangtze, which will probably be the first in a long chain stretching from Nanking *via* Wuhu, to connect with the Chekiang-Kiangsi line at Kwangsingfu, and continuing southwards through Yenping, ultimately to reach Foochow, a maritime city in Fukien. The Kwangsingfu-Yenping section of this project is already being surveyed.

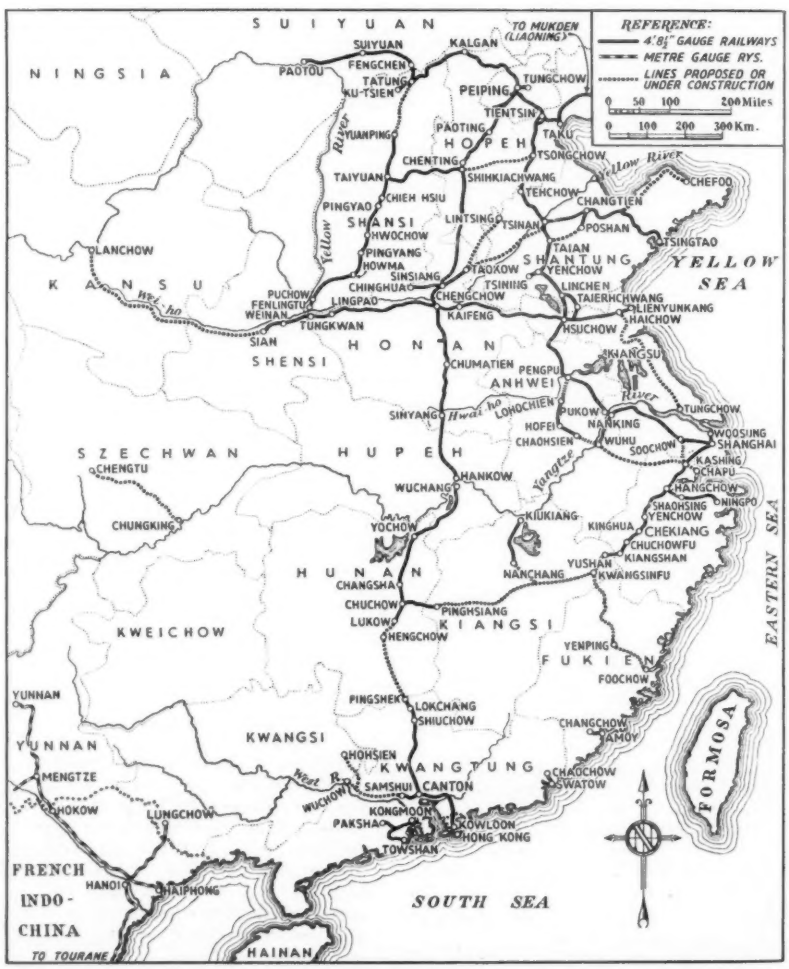
Early in May a further 30-40-mile section of the Tatung-Puchow southern extension was opened as far as Pingyang (Linfen), and the second section of the Hwainan line, from Hofei-Chaohsien, a distance of about 45 miles, was completed during the first half of July, though it does not appear to have been opened for public traffic until September 1.

August 1 was an important date in the history of the Tatung-Puchow Railway, as two sections, one north- and the other southwards of Taiyuan, were then inaugurated: these were from Taiyuan to Yuanping, 70 miles to the north, and from Pingyang to Howma, 30 miles towards Puchow. News has also just been received that the final southern link in this chain between Fenlingtu and Howma has been completed. Fenlingtu (near Puchow) is the southern terminal of this line, where connection will be made with the Lung-Hai Railway. It is remarkable that of the 370-mile length of the Tatung-Puchow line now open between Yuanping and Fenlingtu, about 290 miles have been opened during the twelve months under review.

Military labour has been employed to a considerable extent upon this construction, which is of a very light standard, a fact largely responsible for the rapid progress.

Finally the Lokchang-Lochiatu section of the Canton-Hankow Railway has been completed through difficult country, and brought into use. News of the completion of this line northwards of Pingshek to Lochiatu has just come to hand, too late for inclusion in the map.

Meanwhile there are several important lines under construction no lengths of which have been opened during the year. The Yushan-Nanchang extension of the Chekiang-Kiangsi Railway, would have been opened about now but for abnormal floods. Construction is also understood to be in hand on the Soochow-Kashing chord line that will short-circuit Shanghai and give direct north-south communication between Nanking and Hangchow. The northernmost section of the Hwainan Railway is also under construction between Lohochien and Pengpu, on the Tientsin-Pukow line, to give access from the latter to the Hwainan collieries.



Sketch map of China showing railways completed up to October, 1935

New West London Trolleybus Services Inaugurated

On Sunday last, the inauguration of the new trolleybus services which replace trams from Shepherd's Bush via Chiswick, Kew, and Brentford to Hounslow, and from Hammersmith via Chiswick, Kew, Brentford, Twickenham, and Hampton Hill to Hampton Court, was marked by a visit to Hounslow depot by Lord Ashfield and other members of the London Passenger Transport Board, distinguished visitors, and representatives of the press. The conversion, brief details of which were given on page 686 of THE RAILWAY GAZETTE of last week, affected altogether some 15 route miles.

A fleet of 52 new trolleybuses has been built for operating the Shepherd's Bush to Hounslow and Hammersmith to Hampton Court services. Each vehicle seats 70 passengers—38 in the upper deck and 32 in the lower. The bodies have been built by Metro-Cammell-Weymann Motor Bodies Limited, on chassis made by the Associated Equipment Co. Ltd., with electrical equipment supplied by the English Electric Co. Ltd. The vehicles are particularly quiet in operation, a special overhead contacter having been developed to replace the conventional pulley-wheel pick-up. The interior appointments are both tasteful and comfortable. Remarkable agility on the road is achieved through the trolley booms being so constructed that the vehicles can deviate as much as 13 ft. from the centre line of the overhead wires. Another novel feature is that each trolleybus can, if necessary, move for a short distance under battery power.

The old Hounslow tramway depôt is being completely reconstructed and almost doubled in size in order to accommodate 35 of the new trolleybuses. A new roof has been put on the original building, and has been extended over the whole of the forecourt bringing the face of the building flush with the roadway. A central block of offices, stores, canteen, clubroom, &c., running three-quarters the length of the building, separates the washing and cleaning plants from the area in which the trolleybuses are lined up ready for service. The depôt is equipped with a combined traverser and turntable, supplied by S. H. Heywood & Co. Ltd. of Reddish, which enables the vehicles to be reversed as necessary, and housed economically without the turning space otherwise required. The Fulwell depôt, already used by some of the London United Tramway trolleybuses and taken over by the board in 1933, required little alteration.

The party returned to Hammersmith in one of the new vehicles, and adjourned there to a luncheon, at which Sir Henry Maybury, a Member of the board, presided. In the course of some short informal speeches after the lunch, various interesting facts were disclosed.

Mr. T. E. Thomas, General Manager, Tramways, said that it was the co-ordination effected under the board which had made possible the development of trolleybus in London. Mr. L. W. Reeve, Chairman and Managing Director of the Associated Equipment Co. Ltd., said that by the early summer of next year it was expected that there would be another 300 trolley buses in service. He explained that trolleybuses were cheaper to operate than petrol omnibuses or tramcars, providing the body responsible for running them had a financial interest in the electricity supply. Mr. S. Maddocks, Chairman of the Commissioners for Road Transport in New South Wales, said he had been much impressed by the new trolleybuses, and thought it quite possible that orders from his own country might be placed in England in due course.

Amongst others present at the Hounslow inspection were: Sir Edward Holland and Mr. John Cliff (members of the L.P.T.B.), Lt.-Col. J. T. C. Moore-Brabazon, and Messrs. A. V. Mason, G. H. Brooks, and E. Rawdon-Smith.

MINISTRY OF TRANSPORT ACCIDENT REPORT

Between Pontsarn and Peterston, G.W.R.; July 15, 1935

This was a report by Colonel Trench, and concerned a local up passenger train which ran into some cattle passing over an occupation crossing from the up to the down side of the line. Four cows were killed, and two had to be destroyed. The train consisted of four bogie coaches, drawn by a 2-6-2 type tank engine, running bunker first. The leading wheels of the trailing bogie of the first coach were derailed, but there was practically no damage to the trains and no personal injuries.

The farm hand who was driving the cattle across, Brinley Richards (who impressed Colonel Trench as being of an unusually alert and intelligent type), said that he had been driving cattle over the crossing for about seven months, and that there were usually about 15 cows taken across in the morning and back in the afternoon. For the first few weeks he had been accompanied by his employer, Mr. Thomas, who warned him to open the far gate first, to look up and down the line, and to listen and to look at the signals. Richards did not apparently appreciate that the "on" aspect of distant signals is not a reliable indication of the absence of any train, although Mr. Thomas said that he told him. He said that he usually crossed a little after 9 a.m., when he knew by experience that there was a gap between the trains, and he thought that the total time of crossing was about two minutes. On this occasion he brought the cattle down to the east side of the line at the usual time and left them at the gate in charge of his dog. A light engine passed him on the up line, after which he crossed the line, opened the far gate, and took a good look for trains both ways; he saw the down distant for Pontsarn and the up distant for Peterston, 230 yds. and 180 yds. respectively from the north side of the crossing, in the "on" position, went back to the East gate and opened it.

Colonel Trench has no reason to doubt that Driver Jones was keeping a good look-out, and took all possible measures to avoid the collision; he does not consider that any blame should be attributed to him. On the other hand, Richards had also taken all proper precautions. He was handicapped by the short view due to curvature and was to some extent misled by the unfortunate coincidences that the timing of the train had just been advanced five minutes, that a light engine had just passed on the uproad, the difficult road as regards vision, and that the distant arms of both roads were in the "caution" position.

After saying that Mr. Thomas also should not be blamed, and that the accident must be attributed to misadventure, Colonel Trench concludes:—

"As a main conclusion, it is clear that under normal conditions cattle can cause derailment of a locomotive-hauled train; it would appear that this risk is likely to be substantially greater in the case of multiple-unit trains, the use of which is now extending into country areas where cattle crossings are more frequent than in the suburban areas to which this type of train has hitherto been confined.

"Two other points came to notice in this case; it is evident that the accident was largely due to the altered timing of the train. In cases of regular daily user of a somewhat blind crossing the railway staff are probably aware of the normal times of such use, and should be encouraged to give warning to a user of any material alteration of train timings, but too much stress must not be put on this point lest it should engender a false sense of security.

"The second point is that it is very desirable that all users of occupation crossings should understand that a distant signal—an arm with a fish tail end, usually painted yellow—is only an advance warning to an engine driver, and the fact that it may be in the horizontal position, commonly described as at "danger," does not necessarily mean that no train is approaching."

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RAILWAY AND OTHER MEETINGS

BUENOS AYRES & PACIFIC RAILWAY CO. LTD.

The annual general meeting of the Buenos Ayres & Pacific Railway Co. Ltd. was held at Winchester House, Old Broad Street, E.C., on October 29, the Viscount St. Davids, Chairman of the company, presiding. The Secretary (Mr. C. E. Rich) read the notice convening the meeting and the auditors' report.

The chairman, in moving the adoption of the report and accounts, said that it was necessary to preface his review of the year's operations with some comments on railway competition in Argentina. Four years ago the Argentine Government took powers to extend the State line from Pié de Palo, near San Juan, to Mendoza. On representations from the company, this project was dropped. Two years ago it was revived, money for construction was voted, and work began. Except for a short stretch near San Juan, this railway was being built through barren country unsuitable for irrigation. Its object could not therefore be to develop new traffic, but to parallel the company's own San Juan-Mendoza line for competitive purposes.

The chairman thought there were immense possibilities for the further development of Anglo-Argentine trade, instancing particularly the raising of pigs in Argentina and the demand therefor in Great Britain, but he was bound to say that it did not help business between two countries if the citizens of one started with a deep sense of grievance against the Government of the other.

Turning to the company's results, the chairman said that the net revenue of £9,015,000 showed a considerable improvement on the result of the year before. During the past financial year, however, the company's remittances were not sufficient to allow payment to be made of debenture interest in arrears. In June and July remittances had improved, so making it possible to pay three coupons of arrears on B.A. & Pacific and Argentine Great Western debentures, these payments amounting to £242,000. Moreover, as the balance sheet showed, on June 30 last the company had paid off its bank loan and also the arrears of income tax owing.

As to working expenses, shareholders knew that the company was operating under restrictions and regulations which added to its difficulties, but to June, 1933, working expenditure had been reduced by £212,000, and a further reduction of £193,000 was secured to June, 1934; there had been an increase under this head of £29,000 to June, 1935, but that was accompanied by an increase in gross receipts of £396,000. Loss on exchange had again been a terrible drain on profits, a rate of 17·17 dollars to the pound having been the average during the past year as against 16·08 dollars in 1933-34. Two years ago the loss due to this cause was £85,000, but last year it had amounted to £863,000.

Considering prospects for the present year, those for fine cereals were very bad. From May to July there had been a drought, and during part of that time the ground was too hard to plough. It was estimated that 35 per cent. of the territory that should have been under wheat, linseed, and oats was unsown, while 31 per cent. of the crop sown had already been lost, so that even if all went well henceforward, the crop of these cereals would not be half that of last year. Later, rain had been much more plentiful, and the sowing of maize might do much to make up for the other deficiencies. There was bound to be a big falling off in wheat traffic during the next half year, and the chairman did not think that the final result could be as good as that in the year under review.

The company was doing everything in its power to improve the present conditions. Mr. Eddy, one of the directors, was already in Argentina; Mr. Howard-Williams was sailing next Saturday, and he would be followed in a week or two by Mr. Goudge and Mr. Mallet.

Shareholders might ask if there was not one thing to relieve what had been on the whole a doleful speech. He reminded them that in June, 1934, he had said that there would soon be a payment on arrears in debenture interest, and a week later it had been announced that the money would follow on August 2. Today he was able to state that in a month's time the company ought to pay two more coupons of arrears on the second debentures of the B.A. & Pacific and Argentine Great Western companies.

The report and accounts were unanimously adopted.

SOUTH INDIAN RAILWAY CO. LTD.

The annual general meeting of the South Indian Railway Co. Ltd. was held at 91, Petty France, Westminster, on October 30, Sir Ernest A. S. Bell, C.I.E., Chairman and Managing Director, presiding. The Assistant to the Managing Director (Mr. C. A. Worsfold) read the notice convening the meeting and the auditors' report.

The chairman, in moving the adoption of the report and accounts, referred to the record of his predecessor, the late Mr. Alexander Muirhead, C.I.E., who had served the company with great distinction from the date of his appointment as Agent in 1911 until the day of his death. Sir Percy Rothera, O.B.E., had been appointed to the board to fill the vacancy caused by the election of a new chairman, and he had been succeeded as Agent in India by Mr. C. A. Muirhead, son of Mr. Alexander Muirhead.

The chairman considered that the interests of shareholders were adequately protected by the constitutional changes affecting companies working under contracts with the Secretary of State in Council which had now become law. As a contribution from the Government share of any surplus from Indian railway revenues was an important part of the Federal financial structure, it was to be expected that the Statutory Railway authority would do its best to produce a surplus.

The company was still faced with road motor competition, which was a difficult problem owing to the fact that roads belonged to local governments, whose interests conflicted with those of the Central Government which controlled the railways. It had to be recognised that motor transport had come to stay, and was for the good of the community. Development ought to take place, however, in areas now devoid of transportation facilities. The railway had abandoned plans for building branch lines in some districts where road facilities existed, and it was to be hoped that the operators who were thus left a clear field would use their vehicles as feeders to train services.

Meanwhile, competition was being met by reducing fares, improving the convenience of services, and stopping local trains at level crossings in addition to the regular halts. Over 2 million more passengers than in the preceding year had been carried in areas where low fares were in force.

Traffic in the Madras electrified area continued to expand, and more passengers had been carried for a lower train mileage. Considerable savings had also been effected in the cost of electric current, and the results as a whole reflected great credit upon all concerned with their realisation, and upon the company's consulting engineers, Messrs. Robert White & Partners.

Trade at Cochin Harbour was still improving. The port was now well served by passenger liners. It was proposed to extend rail communication to Venduruthi Island, and to provide wharves, warehouses, and transit sheds there. There would also be a passenger station on the island. It was hoped that these plans would develop new traffic in the hinterland of the port.

Turning to the report and accounts, the chairman said that the line, 5·6 miles in length, from Agastiyampalli to Port Calimere, should be completed shortly. Further construction in the near future was unlikely. Goods and miscellaneous earnings had increased, and gross earnings had increased by just over Rs. 13·73 lakhs. Public merchandise carried was up by over 241,000 tons, but passengers fell off by 156,398. Working expenses, higher by just over Rs. 6¾ lakhs, represented 57·17 per cent. of gross earnings, com-

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pared with 57·39 per cent. in the preceding year. The reduction of the dividend from 8 per cent. to 6½ per cent. might come as a disappointment, but the former figure had been maintained for the last 4 years only by drawing heavily on the surplus profits account—to the extent of £73,558. Figures of operation in the first half of the current year were very disappointing, and unless a substantial improvement was shown in the second half, the dividend might have to be further reduced.

The report and accounts were unanimously adopted.

BUENOS AYRES GREAT SOUTHERN RAILWAY CO. LTD.

The ordinary general meeting of the Buenos Ayres Great Southern Railway Co. Ltd. was held at River Plate House, Finsbury Circus, E.C.2, on Wednesday, October 30, Sir Follett Holt, K.B.E. (Chairman of the company), presiding.

In the absence, through illness, of the Secretary (Mr. Robert Graham) the Acting Secretary (Mr. N. F. E. Grey) read the notice convening the meeting and the auditors' report.

The chairman, in moving the adoption of the report and accounts, said that since the last meeting they had suffered heavy personal losses. Mr. Henry Charles Allen, the late Chairman, whose life for more than fifty years had been wrapped up with the interests of the Great Southern, Sir Herbert Gibson, the Chairman of the Local Board in Buenos Aires, and Mr. Frank Henderson, at one time General Manager and in after years associated in many ways with the interests of this company, had passed away.

Sir Guillermo Leguizamon had succeeded Sir Herbert Gibson in Buenos Aires, and Colonel Harper had succeeded Mr. Allen in London.

With regard to the joint operation of the Southern and the Western the action taken and the steps proposed to be taken by the directors had been endorsed by a decree of the President of the Republic who personally had shown his sympathy with the efforts being made to re-establish the railway industry on a solid basis. Even if friendly rivalry alone had existed, with the human factor ever present they would understand the difficulties involved in welding together the working of two great undertakings employing between them some 37,000 men springing from many different races. Moreover, governments, labour legislation, trade treaties, quotas, depreciated currencies and exchange restrictions had become factors of constant disturbance. In all these circumstances with problems arising from so many directions they searched for a man with the required attainments to face them, and had placed Mr. C. R. S. Harris, who was in the prime of life, in charge of the two railways and they had every reason to be satisfied with their choice. On Colonel Harper joining the board they appointed the Secretary of the Western, Mr. Robert Graham, as Secretary of the Southern also. The financial entity and accounts of the two companies remained undisturbed, but they were now finally operated as one with public advantage and increasing efficiency.

The receipts in pesos showed an increase of 4·2 per cent. and expenses an increase of 3·05 per cent., the latter being mainly due to an unexpected payment they were called upon to make to their employees under the Presidential Labour Award, being equivalent to 5 per cent. on their wages for nine months of the year's working. As some set-off to this additional charge during the current year, from November 1 the same award provided for a greater flexibility in the use of certain classes of labour, but the economies expected to result would fall far short of the additional wage charge that had been thrown upon the company. But it was the exchange loss, amounting to the increased sum of £1,552,722, which finally crippled the company.

It was somewhat remarkable and it was also an encouraging feature, that in spite of all that had since happened in trade restrictions and in road competition the volume of business on the railway was within 5 per cent. of that carried in 1929, when a dividend of 8 per cent. was paid on the ordinary stock. In the intervening years, however, road competition had exerted its influence on rates and it was a fact that, apart from the actual loss of traffic to the roads, had the company been in a position to obtain the same rates last year on the traffic carried as it obtained in 1929 the revenue even at the present rate of exchange would have been £875,000 higher and would have covered preference dividends with a small margin for the ordinary stock. As the railway covered an immense and productive zone and carried last year about 14 million tons, a volume which could not in any imaginable circumstances be carried by road, if they could check a further decline in rates, the foundation of their business would remain and they would look to a concession in exchange, lower operating costs, increasing production, and the passing of a sound Transport Bill, to recover their position. Fortunately during the past few difficult years they had been able to maintain equilibrium in their cash position, the company being quite free from any floating indebtedness.

At this stage some rather general observations were called for on the present position of the British capital employed in building, equipping, and operating 64 per cent. of the total railway mileage in Argentina, representing an investment of £277 million sterling of British money. Although varying in some degree regarding equipment and solidity of track, the 16,735 miles of railway concerned might be said adequately to supply the needs of the country traversed. Not only had these railways conduced in a major degree to the heavy production and exports of the country, but the standard of organisation set throughout vast territories had during the last fifty years a potent influence on the nation's development. An examination of the market value of this huge British investment showed that there was a present depreciation of £181 million, which was an index of the poor reward allowed to these great enterprises.

The United Kingdom purchased from Argentina during the last known twelve months produce to the value of £47,000,000, representing more than one-third of the total value of the exports of that country. The retention of such a wonderful market and the goodwill of such a valuable customer, therefore, were vital if the economic position of Argentina was to be maintained. The interest earned on the capital invested in British-owned railways there now amounted to only 1·5 per cent. If only a first step, to raise this even to the low rate of 3·4 per cent., or one-half of the 6·8 per cent. contemplated by the Mitre Law which was the charter under which they worked, the British railways as a whole would require to earn an additional £5,200,000 per annum. This increase might be secured through various channels: by an improvement in the rate of exchange allotted by the Government, by a decrease in overhead operating charges, by not being forced to employ labour that was not required, by a scientific re-adjustment of tariffs, by permission to pool resources in certain districts, and by the prevention of devastating competition between the various means of transport.

They had all suffered severe disappointments. It was true that a new Government measure, designed to give greater facilities to the railways to work together more closely and more economically, had been presented recently to Congress, but the important Co-ordination of Transport Bill, also a Government measure which had been under discussion a long time, in spite of the personal intervention of the President of the Republic and the Minister of Public Works, after having passed the Deputies was prevented from becoming law before the close of the session last month owing to lack of time. In the passage of the Bill through the Deputies an unexpected interpretation was given to one of its clauses, and amendments were introduced.

The present situation had encouraged a pronounced feeling of dissatisfaction throughout the United Kingdom, and they would look forward impatiently but still with confidence to a return of those happier days when the nationals of both countries were proud of their close and friendly association in trade enterprise and finance and enjoyed the mutual benefits that accrued.

The report and accounts were adopted unanimously.

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Figures, Facts, and Fallacies

Mr. George Mills, F.S.S., M.Inst.T., Divisional General Manager, Scottish Area, L.N.E.R., delivered his inaugural address as Chairman of the Institute of Transport (Scottish Section) at Edinburgh last Monday. In taking as his subject "Figures, Facts, and Fallacies" it was his intention, he said, to examine the one final test by which the efficacy of enterprise and experiment could be measured. It was easy to say that figures could be made to prove anything, and such an attitude was sometimes a convenient refuge from disagreeable facts. But the days of rule of thumb methods had gone, and now that the demand for progress obliged the railways to be continually exploring uncharted fields, figures gave them guidance which was essential if they were to reach their destination.

As an example of the way in which the study of figures had initiated successful policy, Mr. Mills quoted the reduction in passenger fares. This step had been preceded by long examination of losses in passenger traffic, so that it was taken with full knowledge of the economic factors involved. Such concessions had to be scrutinised more carefully by railways than by bus undertakings, for the high proportion of working expenses to total costs in the case of road motor transport allowed greater possibility of swift adjustment of expenditure to income than could be achieved by the railways, with their much larger overheads.

It was impossible to overestimate the value to all transport undertakings of attaining the highest standard of punctuality. Unpunctuality was not only bad advertising and bad service, but should be regarded as an unforgivable sin owing to the way in which it dislocated the delicately adjusted mechanism upon which the economic provision of transport depended. Mr. Mills instanced a case in which an important freight train unavoidably leaving 43 min. behind time had caused a total delay of 382 min., involving ten other services. Supposing a late arrival at Edinburgh by the Flying Scotsman of even 20 min., three passenger trains to points as widely separated as Glasgow, Aberdeen, and Perth would lose their paths, suffering delays *en route* themselves, holding up following trains, and facing the operating department either with the wholesale cutting of advertised connections or the risk of serious cumulative delays over an extensive area.

Mr. Mills then considered the bearing of statistics on the annual coal bill of the L.N.E.R., which now amounts to over £3,000,000. In 1934 the company's engines of all types averaged a coal consumption of 55 lb. per engine-mile, though separate results varied from 52 lb. for passenger engines to 66 lb. for goods and 37 lb. for shunting types. The selection of qualities of coal in which calorific value, fusing point, and ash deposit are combined in values appropriate for the various classes of service required detailed study of statistics. Not only was it necessary to purchase suitable coal, but to weigh up the claim of efficiency and cost of transport to the depot.

Like coal consumption, the valuable statistical unit of net ton-miles per engine-hour was subject to the influence of various factors, which had to be analysed in assessing the final result for different classes of traffic. It was to be noted that the L.N.E.R. figure of 491 net ton-miles per engine-hour in 1934 improved upon the result of 477 in 1933, which had been the highest obtained by any company since the amalgamation.

Concluding, Mr. Mills urged a critical approach to the interpretation of statistics, which should not be allowed to blunt imagination and foresight. The results of advertising, for example, were cumulative and hard to reduce to figures, but none the less real for that.

At the end of his paper, Mr. Mills departed from established practice at inaugural addresses by inviting a discussion, and some twelve speakers showed their appreciation of this step by debating various points he had raised.

Institution of Railway Signal Engineers

The fifteenth annual dinner of the Institution of Railway Signal Engineers was held in London on October 25. The chair was taken by Mr. H. E. Morgan (President). Among the guests present were: Messrs. E. J. H. Lemon (Vice-President L.M.S.R.), S. B. Carter (Outdoor Superintendent, L.M.S.R.), and R. A. Riddles (Assistant to Chief Mechanical Engineer, L.M.S.R.). Among the others at the President's table were: Col. E. C. Trench (Inspecting Officer of Railways); Messrs. A. F. Bound (Signal and Telegraph Engineer, L.M.S.R.), and H. C. Way (Signal Engineer, Bombay, Baroda & Central India Railway).

Responding to the toast of the Institution, proposed by Mr. W. S. Roberts, the president said that never, in the history of railways, had so much importance been attached to signalling. Attention was being focussed upon the possibilities of increasing the carrying capacities of the railways, concurrently with a decrease in the cost of operation. Railway managements recognised that improvements in signalling methods had provided a field well worth exploration before more expensive measures were considered.

The toast of "The Visitors" was proposed by Mr. Bound, who said that they were fortunate that evening in having with them Mr. E. J. H. Lemon, whose presence paid a three-fold compliment. It was first a compliment to the institution for the work it had done and was doing; secondly, it was a compliment to their president, who was a colleague of Mr. Lemon's in the Midland days; finally, it was a compliment to the many members of the department for which he, Mr. Bound, was responsible, who were present that evening.

Colonel Trench, who also was with them, being a member of the institution, could not be included in the toast, but Mr. Bound wished to take the opportunity of saying how pleased they were to see and welcome the Inspecting Officers of Railways at the annual dinners. The signalling profession was in close and constant touch with the inspecting officers, and he could say that the relationship was never more harmonious than at present.

Mr. Lemon, in replying, said that he would give place to no one in his gratitude to the signal engineers for the help they rendered in the operation of railways, and in reducing working costs to less than they had been at any time. Testimony to that had proceeded from high places, as instanced by the quotation given in THE RAILWAY GAZETTE of October 11 from a speech by Mr. Whitelaw. Sir Josiah Stamp and others had also given similar evidence on other occasions. Signal engineers had contributed, too, to the railways' marvellous record of safety, when considered in comparison with other means of transport. With a system that was one hundred years old, things were often taken for granted, and waste resulted. They had now to load the line to its fullest capacity, and when it was considered necessary to widen the railway it was their duty to see if signalling could not give the desired relief instead.

Speed was something railways could sell. There was no such competition in the old days as existed today; they used to be satisfied with 60 m.p.h., at a time when it had to compete only with 15 m.p.h. on the road. Now they wanted 250 m.p.h. There was the very serious problem of braking distance for the high-speed trains that were being introduced. He agreed with Mr. Roberts and the president as to the value of research work, and trusted that signal manufacturing firms were considering the mass production of standard equipment. Finally, he appealed to the members of the institution to get young people of education into the industry to take the place, when the time came, of their elders.

Mr. Way responded to the toast of the Overseas members, proposed by Mr. J. Boots and a very enjoyable dinner was followed by a successful dance at which Mr. C. H. Hills acted as M.C.

NOTES AND NEWS

Refreshments for L.M.S.R. Sleeping Car Passengers.—Tea and light refreshments for sleeping car passengers will become officially available on the L.M.S.R. on and from Monday next, November 4.

The German Railway Centenary Exhibition.—Over half a million persons visited the exhibition of the German railways, "A Century of German Railways," at Nuremberg. More than a hundred special trains were run to carry visitors to the exhibition, which closed on October 13.

Manila Railway Co. (1906) Ltd.—Adjourned meetings of the holders of the A and B debenture bonds and stock of the Manila Railway Co. (1906) Ltd. were held on October 24 at Winchester House, Old Broad Street, E.C., when the resolutions approving the scheme of arrangement were unanimously adopted.

Irish Exceptional Rates.—New exceptional rates, more than 40 per cent. below the standard rates chargeable, which were recently granted by the Great Southern Railways Company, have received the sanction of the Railway Tribunal. Amongst the changes was the substitution of a zonal rate for the previous flat rate of 6s. a ton for turf.

G.W.R. Fog Telephone Service.—With a view to assisting telephone subscribers within the London Telephone Area, the G.W.R. has entered into an arrangement with the Post Office whereby information may be obtained by enquiry of the telephone operator as to whether train services are affected by fog or other unforeseen circumstances. Similarly, advice will be given on application when the normal train service has been restored.

Road Accidents.—The Ministry of Transport return for the week ended October 26, of persons killed or injured in road accidents is as follows. The figures in brackets are those for the corresponding period of last year :—

	Killed, including deaths resulting from previous accidents	Injured
England ...	109 (148)	3,564 (4,069)
Wales	2 (8)	140 (163)
Scotland ...	11 (13)	283 (379)
	122 (169)	3,987 (4,611)

The total fatalities for the previous week were 141, as compared with 153 for the corresponding period of last year.

Mr. R. E. Charlewood.—We regret to learn from a Reuters message that Mr. R. E. Charlewood is under preventive arrest in Frankfort-on-Main, Germany. Mr. Charlewood was, until his retirement at the end of last year, an officer in the Operating Department of the L.M.S.R., and is an occasional contributor to THE RAILWAY GAZETTE and a keen student of railway methods. Apparently, he was seen making a sketch from a railway carriage window, of details of the German railways, which the authorities considered suspicious. Mr. Charlewood has been accustomed to do this, both in his professional capacity and as a personal hobby, in the many countries he has visited. We understand the Foreign Office has the matter in hand.

New Polish Railways.—The Polish State Railways Administration is building the following new lines : Mlawa-Ostroleuka-Chorzele (93 km.) ; Zegrze-Wyszkow (40 km.) ; Sierpce-Brodnica (55 km.) ; and Sierpce-Lubicz (86 km.).

Further German Electrification.—At a cost of 114,000,000 RM., the Reichsbahn is to electrify the main line from Nuremberg to Halle and the offshoot from Corbetta to Leipzig, a route mileage of 216. The conversion work is to begin before the end of this year and will be finished by the end of 1939. Of the total estimated cost given above, 46,000,000 RM. will be expended on rolling stock.

Canadian Pacific Earnings.—Gross earnings of the Canadian Pacific Railway for the month of September, 1935, amounted to $13,446,000, an increase of $1,403,000 in comparison with September, 1934. In the working expenses of $10,156,000 there was an increase of $1,146,000, leaving net earnings $257,000 higher, at $3,290,000. For the nine months to September 30, 1935, gross earnings were $92,041,000, an increase of $1,141,000, and net earnings $11,387,000, a decrease of $2,283,000.

Canadian National Earnings.—For the month of September, 1935, gross earnings of the Canadian National Railways amounted to $15,901,121, an increase of $960,852 in comparison with September, 1934. Operating expenses ($13,608,449) at the same time advanced by $678,423, leaving net earnings $282,429 higher, at $2,292,672. Aggregate gross earnings from January 1 to September 30, 1935, were $125,130,179, an improvement of $3,167,470, but the aggregate net earnings of $6,165,664 showed a decrease of $976,840.

Northern Ireland Traffics.—On railways wholly in Northern Ireland, the number of passengers (exclusive of season-ticket holders) carried during the first six months of 1935 was 2,286,596, against 2,126,066 for the corresponding period of 1934, and receipts from passengers were £107,243 compared with £99,988. Merchandise and minerals carried in the first six months of 1935 were 279,364 tons, against 285,751 tons for the corresponding period of 1934, and the total receipts from goods traffic were £92,702, against £94,992. On railways partly in Northern Ireland, passengers in the first six months of 1935 numbered 2,446,022, against 2,041,683 for the corresponding period of 1934, and passenger receipts were £182,385, compared with £168,958. Goods and minerals carried in the first six months of 1935 were 485,547 tons, compared with 479,914 tons in the first half of 1934, and total receipts from goods traffic were £302,674 against £288,215.

Wood-Gas Propulsion.—A number of railcars deriving their power from wood-gas generators feeding Bussing-N.A.G. engines of 75 to 100 b.h.p., are in use on small railways in Germany, such as that from Nauen to Brandenburg, and on the Lithuanian State Railways. The consumption of dry wood is about 2 lb. per b.h.p.-hr., and about 5 lb. of wood is equivalent to one litre of petrol. Sufficient fuel for a run of about 150 miles is carried on some of the cars.

"The Late Christopher Bean."—On Friday and Saturday of last week the L.M.S. Railway (London) Amateur Dramatic Society gave excellent performances at the Cripplegate Institute of the familiar play, "The Late Christopher Bean." The nine characters were all well portrayed and Mr. W. F. Humphreys, the producer, well deserved the compliment paid by Sir Josiah Stamp on Saturday night to the adequacy of the casting. The Stage Manager was Mr. W. W. Sharp. Incidental music was provided by the L.M.S. (London) Orchestral Society.

Line Alterations at Vauxhall, S.R.—In connection with the extensive re-arrangement and re-signalling of the lines between Waterloo and Wimbledon, the Southern Railway announces the temporary closing of the down main-line local platform No. 4 at Vauxhall from November 3 for about 18 weeks, so that it may be replaced by a new island platform served by both up and down main-line locals. During this period of transition, passengers from Vauxhall to the stations served by the down local trains may travel up to Waterloo to join their trains, or down to Clapham Junction by Windsor line trains, and change there.

New L.N.E.R. Locomotives.—The L.N.E.R. has decided to name a new series of B.17 "Sandringham" class 3-cylinder express locomotives after famous sporting clubs. Fourteen now under construction at Darlington works will bear the names of the following famous association football teams which week by week are conveyed over the L.N.E.R. to and from their fixtures : *Huddersfield Town, Derby County, Sunderland, Middlesbrough, Sheffield Wednesday, Arsenal, Manchester City, Leeds United, Grimsby Town, Doncaster Rovers, Newcastle United, Sheffield United, Norwich City*, and *Hull City*. It is understood that some of these engines will be used on the express services between Marylebone, the Midlands and Manchester. The remaining two engines of the "Silver Link" type now approaching completion at Doncaster works will be called *Silver King* and *Silver Fox*. These engines will shortly be put in service between Newcastle and London on the Silver Jubilee train.

XUM

British and Irish Traffic Returns

GREAT BRITAIN	Totals for 43rd Week			Totals to Date		
	1935	1934	Inc. or Dec.	1935	1934	In. or Dec.
	£	£	£	£	£	£
L.M.S.R. (6,925¼ mls.)						
Passenger-train traffic...	412,000	407,000	+ 5,000	21,279,000	20,887,000	+ 392,000
Merchandise, &c. ...	483,000	477,000	+ 6,000	19,258,000	19,119,000	+ 139,000
Coal and coke ...	250,000	222,000	+ 28,000	9,732,000	9,652,000	+ 80,000
Goods-train traffic ...	733,000	699,000	+ 34,000	28,990,000	28,771,000	+ 219,000
Total receipts	1,145,000	1,106,000	+ 39,000	50,269,000	49,658,000	+ 611,000
L.N.E.R. (6,336 mls.)						
Passenger-train traffic...	276,000	271,000	+ 5,000	13,857,000	15,558,000	+ 299,000
Merchandise, &c. ...	364,000	363,000	+ 1,000	13,331,000	13,406,000	− 75,000
Coal and coke ...	247,000	227,000	+ 20,000	9,488,000	9,682,000	− 194,000
Goods-train traffic ...	611,000	590,000	+ 21,000	22,819,000	23,088,000	− 269,000
Total receipts	887,000	861,000	+ 26,000	36,676,000	36,646,000	+ 30,000
G.W.R. (3,749½ mls.)						
Passenger-train traffic...	179,000	179,000	—	9,020,000	8,880,000	+ 140,000
Merchandise, &c. ...	202,000	188,000	+ 14,000	7,786,000	7,714,000	+ 72,000
Coal and coke ...	110,000	98,000	+ 12,000	4,202,000	4,267,000	− 65,000
Goods-train traffic ...	312,000	286,000	+ 26,000	11,988,000	11,981,000	+ 7,000
Total receipts	491,000	465,000	+ 26,000	21,008,000	20,861,000	+ 147,000
S.R. (2,171 mls.)						
Passenger-train traffic...	261,000	252,000	+ 9,000	13,164,000	12,799,000	+ 365,000
Merchandise, &c. ...	64,500	68,000	− 3,500	2,628,500	2,787,000	− 158,500
Coal and coke ...	31,500	30,000	+ 1,500	1,261,500	1,307,000	− 45,500
Goods-train traffic ...	96,000	98,000	− 2,000	3,890,000	4,094,000	− 204,000
Total receipts	357,000	350,000	+ 7,000	17,054,000	16,893,000	+ 161,000
Liverpool Overhead ... (6½ mls.)	1,139	1,009	+ 130	51,046	49,171	+ 1,875
Mersey (4½ mls.) ...	4,060	4,027	+ 33	172,817	175,108	− 2,291
*London passenger Transport Board ...	551,300	541,300	+ 10,000	9,226,800	9,097,100	+ 129,700
IRELAND						
Belfast & C.D. pass. (80 mls.)	1,821	1,912	− 91	112,510	111,464	+ 1,046
,, ,, goods	559	546	+ 13	21,726	22,129	− 403
,, ,, total	2,380	2,458	− 78	134,236	133,593	+ 643
Great Northern pass. (543 mls.)	8,700	8,650	+ 50	464,250	441,500	+ 22,750
,, ,, goods	10,500	9,650	+ 850	397,650	374,350	+ 23,300
,, ,, total	19,200	18,300	+ 900	861,900	815,850	+ 46,050
Great Southern pass. (2,124 mls.)	18,427	18,151	+ 276	1,081,507	1,053,849	+ 27,658
,, ,, goods	40,296	38,060	+ 2,236	1,492,484	1,401,608	+ 90,876
,, ,, total	58,723	56,211	+ 2,512	2,573,991	2,455,457	+ 118,534

* 17th week, the receipts for which include those undertakings not absorbed by the L.P.T.B. in the corresponding period last year; last year's figures are, however, adjusted for comparative purposes

Forthcoming Events

Nov. 5 (*Tues.*).—Institute of Transport (Bristol), at Bristol University, 5.40 p.m. "Evolution of the Mail," by Col. S. H. G. Dainton.

Institute of Transport (Metropolitan Graduate), at Inst. of Electrical Engineers, Savoy Place, W.C.2, 6 p.m. "The Future of Railway Stations in Rural Districts," by Mr. P. West.

Institution of Civil Engineers, Great George Street, London, S.W.1, 6 p.m. Presidential Address by Mr. J. D. Watson.

L.N.E.R. (Middlesbrough) Lecture and Debating Society, at Cleveland Scientific and Technical Inst., Corporation Road, 7.15 p.m. "Nightless Days in Norway," by Mr. Cecil J. Allen.

L.N.E.R. (Newcastle-Sunderland) Lecture and Debating Society, at Newcastle, 7 p.m. "Educational Reform," by Prof. Nicholson.

Retired Railway Officers' Society, at Great Eastern Hotel, Liverpool Street, London, E.C.2, 12.45 for 1 p.m. Autumn Luncheon.

Nov. 6 (*Wed.*).—Institute of Patentees, 10, Victoria Street, London, S.W.1, 8 p.m. "The Influence of Invention on Railway Development," by Mr. W. A. Willox.

Institution of Heating and Ventilating Engineers (London), at London School of Hygiene, Keppel Street, W.C.1, 7 p.m. "Electric Thermal Storage," by Mr. J. Eden.

Permanent Way Institution (Leeds), at Quebec House, Quebec Street, 7.30 p.m. "Recent Improvements at Grimsby Docks," by Mr. J. A. Douglas.

Nov. 6–9.—Southern Railway Musical Society, at Fortune Theatre, Drury Lane, London, W.C.2. "A Country Girl."

Nov. 7 (*Thurs.*).—Institute of Metals (London), at Royal School of Mines, Prince Consort Road, S.W.7, 8 p.m. "The Ultimate Strength of Metals," by Mr. E. N. Da C. Andrade.

Institution of Electrical Engineers, Savoy Place, London, W.C.2, 6 p.m. "Equipment and Performance of Steel Tank Rectifier Traction Substations Operating on the Underground Railways of the L.P.T.B.," by Mr. A. L. Lunn.

Southern Railway (London) Lecture and Debating Society, at Chapter House, St. Thomas' Street, S.E.1, 5.45 p.m. "Cinematography in Relation to Railway Work," by Mr. J. Marsterton.

Nov. 8 (*Fri.*).—Civil Engineering Society of Royal Technical College, George Street, Glasgow, 7.45 p.m. "Railway Construction in Western Africa," by Mr. A. C. Rankin.

Institute of Transport (Leeds), at Town Hall, 6.30 p.m. "Organising the Private Motorist," by Mr. E. H. Fryer.

Institute of Transport (Newcastle), at Royal Station Hotel, 7.30 p.m. "Air Ports," by Capt. J. D. Irving.

Railway Club, at Royal Scottish Corporation Hall, Fetter Lane, London, E.C.4, 7.30 p.m. "Continental Railways," by Mr. W. A. Willox.

British and Irish Railways Stocks and Shares

Stocks	Highest 1934	Lowest 1934	Prices Oct. 30, 1935	Prices Rise/Fall
G.W.R.				
Cons. Ord. ...	66½	48½	45½	—
5% Con. Prefce. ...	118	109	112½	+1
5% Red. Pref. (1950)	115	107	108½	—
4% Deb.	117	105	111	—
4½% Deb. ...	119	109	112½	—
4½% Deb. ...	129½	115¼	120½	+1
5% Deb.	135	126¼	133½	+1
2½% Deb.... ...	75	64	71	—
5% Rt. Charge ...	134 7/16	123¼	130½	+1
5% Cons. Guar. ...	132¾	121¾	127½	+1
L.M.S.R.				
Ord.	30½	19½	17½	−½
4% Prefce. (1923)	64¼	41	49	−1
4% Prefce. ...	87	69½	78	−1
5% Red. Pref. (1955)	107	92½	100½	—
4% Deb.	114⅛	100½	105½	+½
5% Red. Deb. (1952)	118 11/16	111¼	112½*	—
4% Guar.... ...	106½	96¾	100½	+½
L.N.E.R.				
5% Pref. Ord. ...	24¾	13½	9¼	−½
Def. Ord.	11½	6⅞	5¼	−⅛
4% First Prefce....	76	59½	51	−1
4% Second Prefce.	47	25½	19	−½
5% Red. Pref. (1955)	94½	80	73½	—
4% First Guar. ...	104	92	95	−½
4% Second Guar.	97⅞	86½	85	—
3% Deb.	90	74½	78	+½
4% Deb.	114	99¼	103½	+½
5% Red. Deb. (1947)	117	108	109½	—
4½% Sinking Fund Red. Deb.	111¼	105¼	109	—
SOUTHERN				
Pref. Ord.... ...	90	63⅛	78	+1
Def. Ord. ...	32⅝	19	18½	−1
5% Prefce. ...	118 3/16	107½	113½	+1
5% Red. Pref. (1964)	115¾	107½	111½	+1
5% Guar. Prefce.	132	120¾	127½	+2
5% Red. Guar. Pref. (1957)	119½	113	115½	+2
4% Deb.... ...	116½	103¼	110½	+½
5% Deb.	134	124 13/16	133½	+2
4% Red. Deb. 1962–67	113 11/16	105 9/16	110½	—
BELFAST & C.D.				
Ord.	6	5	8½	—
FORTH BRIDGE				
4% Deb.	110	100	105½	—
4% Guar. ...	110	100	104½	—
G. NORTHERN (IRELAND)				
Ord.	9¾	4 15/16	16¼	—
G. SOUTHERN (IRELAND)				
Ord.	25	12½	37	−3½
Prefce.	21½	13 15/16	44½	+2½
Guar.	48	39	79½	—
Deb.	67	59	79⅞	+¼
L.P.T.B.				
4½% "A" ...	126	115	120½	—
5% "A" ...	135½	124½	130½	—
4½% "T.F.A." ...	113½	107½	109	—
5% "B" ...	131¾	118	125½	—
"C"	97	73	99	—
MERSEY				
Ord.	15¼	7	13	+2
4% Perp. Deb. ...	93½	82½	94½	—
3% Perp. Deb. ...	66½	61½	69½	−1
3% Perp. Prefce.	54	44½	52½	—

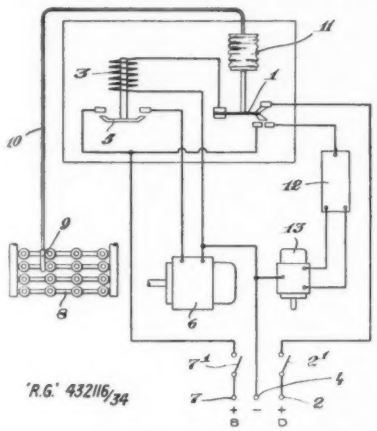
* ex dividend

ABSTRACTS OF RECENT PATENTS*

No. 432,116. Railway Vehicle Ventilation

J. Stone & Co. Ltd., of Deptford, London, S.E.8, and J. F. B. Vidal, of 48, Woodcrest Road, Purley, Surrey. January 20, 1934.

A ventilating and heating installation for a railway vehicle having a fan driven by an electric motor supplied with current from a dynamo, comprises



the combination with an automatic switching arrangement for the motor, of a thermostatic control means so adapted that the switching arrangement operates in dependence upon dynamo activity under summer conditions and upon the thermostatic control under winter conditions. 1 is a reversible switch which normally makes a connection between the positive terminal 2 of a dynamo driven from an axle of the vehicle and one terminal of a solenoid winding 3 having its other terminal connected to the negative main terminal 4. The winding 3, when energised, closes a switch 5 to put a motor 6, driving a fan for supplying ventilating air, between the positive terminal 7 of the battery of the vehicle and the common negative terminal 4, *i.e.*, across the battery. 2^1, 7^1 are the contacts of a manual isolating switch.

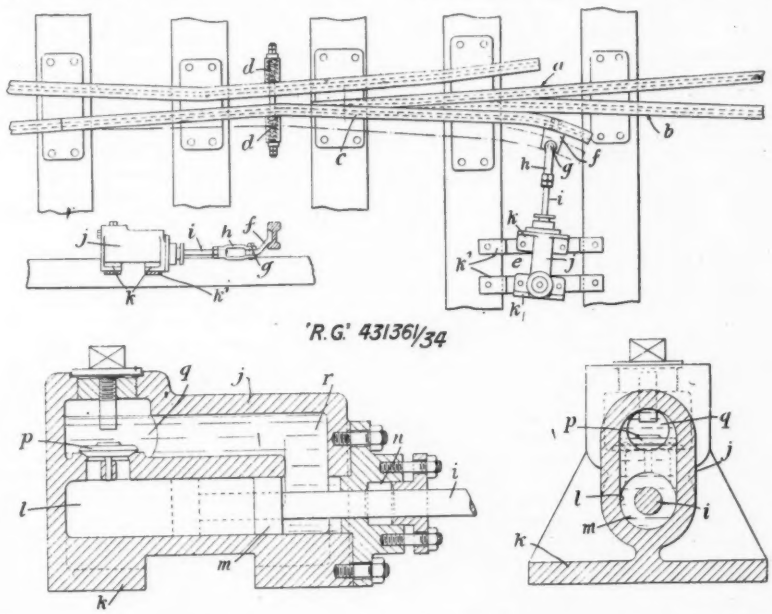
The vehicle equipment comprises air filtering and air heating units, the latter being a steam coil 8 over which the air supplied is passed and which is fed with steam from the locomotive. The thermostat device may be a bulb 9 in contact with the coil 8 and connected by a duct 10 with a motor device, such as a bellows 11, the latter being operative for reversing the switch 1. In its reversed or lower position, the switch 1 disconnects the winding 3 from the dynamo positive terminal 2 and transfers it to the battery positive terminal 7.

A thermostatically operated device 12 controlling the operations of a reversible motor 13 is provided for maintaining an appropriate temperature of the warmed air supplied by the fan. As the motor 13 is required to be active only when the heating coil 8 is active, its circuit is so coupled through the switch 1 that it can be supplied with current only when such switch is set in its lower position by the thermostat 9, 11. Under summer conditions, the coil 8 is disconnected and cold, the switch 1 is in the position illustrated and the fan motor 6 is automatically switched on and off by the switch 3 solely in accordance with the activity or inactivity of the axle-driven dynamo. Under winter conditions, the coupling up of the locomotive with the vehicle, and the opening of the steam connection, results in a sudden heating of the coil 8 which influences the thermostat bulb 9. The expansion effect, transmitted from the bulb to the bellows 11, results in the reversal of the switch 1, whereby the winding 3 is energised from the battery and the fan motor 6 connected through the switch 5, which automatically closes, across the battery terminals 7, 4. Thereupon, the fan motor drives the fan for the induction of air over the heating coil 8 and into ducts which supply the interior compartments. At the same time, the circuit of the thermostatic regulating means 12 is connected across the battery so that the reversible motor 13 may operate, in accordance with the instant temperature, to cause more or less air to pass over, or bye-pass, the heating coil 8. When the locomotive is uncoupled from the vehicle, or when its steam connection with the vehicle is interrupted, the thermostat bulb 9 will cool and permit the return of the switch 1 to the original upper position in which the temperature regulation through the reversible motor 13 is cut off and the circuit between the winding 3 and the dynamo terminals is restored.—(*Accepted July 22, 1935.*)

No. 431,361. Railway Crossings

Henry Williams Limited and D. D. Williams, both of Railway Appliances Works, Darlington. February 8, 1934.

A return movement damping device for the spring operated part of crossings comprises a dash pot having two chambers in open communication with each other at one end and communicating with each other at or near the other end by means of a passage controlled by a non-return valve, and a piston working within one of the chambers and operatively connected to said moving part. The arrangement is such that when the piston is moved in one direction by the moving part, against the action of the spring, liquid flows freely from one chamber



past the non-return valve into the other chamber and then through the intercommunicating ends to the first chamber, and when the piston moves in the other direction the non-return valve prevents the free passage of the liquid from one chamber to the other and the liquid is forced to pass through a restricted opening, thus damping the return movement of the moving part. At *a* is the running face of the main line rail, *b* the running face of a siding rail,

* These abridgments of recently published specifications are specially compiled for THE RAILWAY GAZETTE by permission of the Controller of His Majesty's Stationery Office. Group abridgments can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, either sheet by sheet as issued, on payment of a subscription of 5s. a group volume, or in bound volumes, price 2s. each, and the full specifications can be obtained from the same address price 1s. each

c the switch rail, *d* springs acting on the switch rail and *e* the retarding device. The curved end of the switch rail *c* remote from the heel end has mounted on it at the inner side a bracket *f* having a hole therein through which a bolt *g* passes and pivotally connects the bracket to a forked eye-bolt *h*. The other end of the eye-bolt is secured to a piston rod *i* which is connected to the retarding device. The retarding device comprises a cylinder body *j* mounted upon suitable bearers *k* secured to a pair of sleepers *k*¹. In the cylinder body is formed a bore *l* having a piston *m* therein mounted upon the piston rod *i* which passes through a stuffing box *n* closing the open end of the cylinder. The closed end of the cylinder is provided with a port closed by a valve *p*. This port opens into a chamber *q* in the cylinder body running parallel to the cylinder bore and communicating with the open end of the cylinder through a passage *r*. The cylinder is filled with liquid, such as oil, as well as the chamber and passage. The valve *p* opens so as to permit liquid to pass from the closed end of the cylinder through the port into the chamber but does not permit it to pass in the opposite direction. When the switch is in the normal position due to the influence of the springs the piston is near the open end of the cylinder. When the switch rail *c* is moved by the wheels of a train the piston is pushed towards the closed end, see dotted lines, thus passing liquid through the valve.—(*Accepted July* 5, 1935.)

No. 431,817. Axle Bearings

Eisen-und Stahlwerk Walter Peyinghaus, of Egge bei Volmarstein, Germany. August 14, 1934. (*Convention date: August* 14, 1933.)

A sliding axle bearing for rail vehicles lubricated by means of a pad, comprises a sprinkling ring in combination with a dust packing, fitting against the axle journal clearance race and also against both housing packing faces, the axle journal being prevented from jumping by means of a shock-absorbing ring. 1 is the axle journal, 2 the carrying brass, 3 the lubricating pad, 4 the shock-absorbing rib, 5 the sprinkling ring shrunk on the clearance race 6 of the axle journal, and 7 the dust packing, which fits against the clearance race 6 and also against the packing faces 8 and 9 of the housing 10. The shock-absorbing rib 4 is coated at 11 with a copper strip, so that the axle journal collar 15 of the axle journal is not injured when shocks are received. The front wall 12 of the housing, which wall is near the cover, is raised at 13 above the lubricant store 16, so that the packed joint 14 of the cover is not in the lubricant store. As can be seen particularly from Fig. 2, the top of the carrying brass 2 possesses externally extended abutment-faces 2¹ and abutment-faces 2¹¹ externally at its sides. The housing is strengthened opposite these abutment-faces at 10¹ and 10¹¹, so that it is perfectly stiff. The axle bearing according to the invention guarantees the conditions for the production of the desired fluid friction between the axle journal 1 and the carrying brass 2: moreover, the

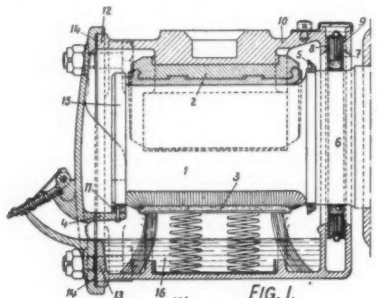
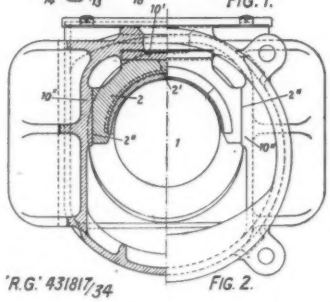


FIG. 1.



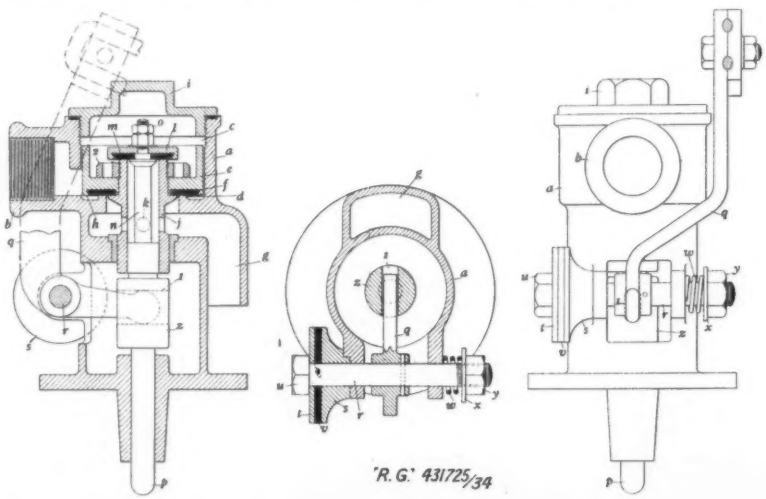
'R.G.' 431817/34 FIG. 2.

axle bearing is permanently lubricated since by the arrangement of the sprinkling ring 5 and the dust packing 7, and also by the raising of the housing at 13, the escape of the lubricant and the entrance of foreign bodies is impossible.—(*Accepted July* 16, 1935.)

No. 431,725. Trip Valves for Rail Vehicle Air Brakes

E.M.B. Co. Ltd. and Stanley Smith, both of Moor Street, West Bromwich, Stafford. March 2, 1934.

The casing *a* of a trip valve used on the air brake systems of rail vehicles has at one end a connection *b* for attachment to the train pipe. This connection *b* opens into a chamber *c* containing an annular seating *d* for the main valve *e*, the valve *e* being provided with an annular leather washer *f* and the seating *d* being in communication with an opening *g* in the casing *a* leading to the atmosphere. The top of the chamber *c* is formed by a closure member *i* screwed into the upper end of the casing *a*. The peripheral portion of the valve *e* overhangs the seating *d* so that air pressure in the train pipe can act on a portion *h* of the side adjacent to the seating *d*. The peripheral portion of the valve *e* is arranged to slide freely in the chamber *c*, a small clearance serving to restrict the air flow to the upper part of the chamber. Axially through the main valve *e* there is arranged a hollow stem *j* which is perforated at *k* adjacent to the exhaust opening *g*. The stem *j* carries the main valve *e*, and the end which is located in the chamber *c* serves as a seating for the smaller subsidiary valve *l*. The lower end of the stem slides through the casing. The operating stem *n* attached to the subsidiary value *l* passes through the hollow stem *j*, and its outer end *p* is such that the stem *n* can be lifted when it strikes a striker or pivoted arm on the track. Movement of the subsidiary valve *l* for opening or closing under the control of the driver is effected through a bell crank lever *q*, one end of which engages in a slot *l* in a block *z* secured to the stem *n*, the bell crank lever *q* being secured to a spindle *r* rotatably carried on the casing *a*. The spindle *r* is associated with a friction device which comprises a part *s*, adapted for non-rotatable engagement with the casing *a*, and a plate *t* secured to the head *u* of the spindle *r*, suitable friction material *v* being interposed between the part *s* and the plate *t*. A spring *w* and a washer *x* hold the parts of the friction device together. When the valve *l* is opened either by the striker, or by the lever *q*, it is held open by the friction device, and can only be closed again by operation of the lever. Normally both of the valves *e*, *l* are held on their



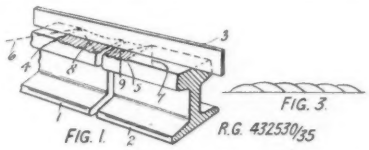
'R.G.' 431725/34

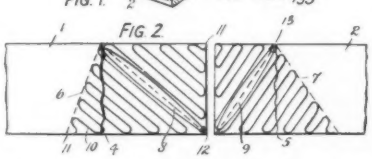
seatings by the air pressure in the cylindrical chamber *c*. When the subsidiary valve *l* is lifted, which can be effected by a relatively small effort, the air pressure in the cylindrical chamber *c* is relieved by being put into communication with the atmosphere. The train pipe pressure acting directly on the overhanging portion *h* of the main valve *e*, or the continued movement of the subsidiary valve which causes the block *z* to engage the lower end of the hollow stem *j*, or both of these actions, then lifts the main valve, putting the train pipe into direct communication with the atmosphere, and causing the brakes to be applied.—(*Accepted July* 15, 1935.)

No. 432,530. Reconditioning Worn Rails

The British Thomson-Houston Company Limited, Crown House, Aldwych, London, W.C.2. March 27, 1935. (*Convention date U.S.A.: March* 27, 1934.)

A method of reconditioning worn rail joints by welding a suitably marked area on each rail end. The end to be welded is marked off to form two triangles, and the deposit is formed by a continuous welding operation which is initiated at the section vertices opposite the diagonal and terminated at one end of the diagonal. The approximate inner limit of wear on the tread of each rail 1 and 2 at the joint is determined by laying a straight-edge 3 on the treads of the rails, longitudinally across the joints. The limits 4 and



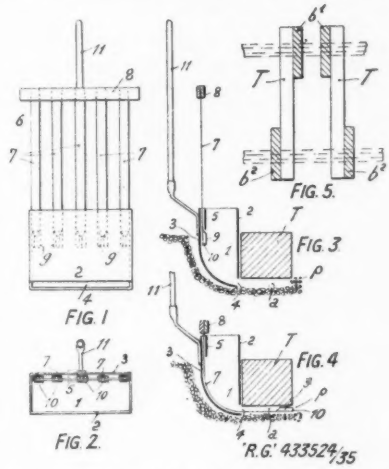


5 are then gauged by observing the distance between the straight edge and the treads of the rails. The inner limit of welding is then marked with oblique lines 6 and 7 which define quadrilateral areas which include the worn surfaces. The areas are then divided into triangular sections by diagonals 8 and 9. The lines 6, 7, 8, 9 may be made in any convenient manner, for example, by chalk lines. The worn surface is then restored by depositing a flat sinuous bead of weld metal 10 in each triangular section by a welding operation which is started at the vertices 11, opposite the diagonals 8 and 9, and terminated at one end of them. To avoid craters in the deposit, each triangular section should be started and finished without a break. In this way only one crater will appear on each rail end, *i.e.*, at the end of the diagonal, and the welding could be so arranged that on one end the crater is at 12 and on the other end at 13. By using a suitable electrode, a very flat bead of weld metal may be obtained. The turns of the deposit should overlap one another a substantial amount, and the final portion of the deposit on the second triangular section of a rail end may completely overlap the final portion of the deposit previously applied to the first section. Although an elevated ridge will result at the diagonals 8 and 9, this is preferable to an insufficient deposit at this point. The reason for dividing the welding area into triangles is that each section may be worked without a stop, a standard 14-in. electrode being just sufficient. Furthermore, by starting and ending each welding operation at the side of the rail, craters or porous pots are eliminated in the body of the deposit. Since a smooth deposit is obtained, the time required for grinding is greatly reduced. This procedure also ensures a better distribution of heat in the rail end. After the treads of the rails have been built up, they are reduced to the same elevation as the adjacent running surface of each rail by grinding. Wherever necessary, the joint is slotted to remove any overflow of weld metal between the rail joints.—(*Accepted July* 29, 1935.)

No. 433,524. Apparatus for Levelling Railway Track

Maurice Henri Lemaire, of 15, *Avenue la Bourdonnais, Paris, France. March* 30, 1935. (*Convention date: March* 20, 1934.)

A method of levelling a railway track in which the sleeper is raised slightly more than the required amount, a channel is then made in the ballast beside the sleeper, into which a container is placed. From this container ballast is forced and packed under the sleeper, raising it the desired amount. The apparatus consists of a container 1, with a front plate 2, and a curved back plate 3. This back plate has a short double wall 5 which provides a slideway in which the movable member 6 can slide. This movable member consists of a fork, the prongs of which are flexible metallic blades, carried by a frame 8, which serves as an operating handle. The prongs are provided at their ends with rigid projections 9, the fronts of which have a facet 10 perpendicular to the direction of the adjacent part of the prongs. The whole apparatus is provided with a handle 11 which serves for transport. To carry out the fly-packing process the track is first treated in the following manner. If it is desired to raise both rails, two narrow bands b_1, b_2 of ballast adjacent to the sleeper, situated at their butt ends but opposite each other, are cleared away. The track is then raised by ordinary means to a height only slightly greater than that which is necessary. The fly-packing is carried out as follows. The apparatus is lowered into the excavation b_1 or b_2, its face 2 placed against the sleeper, and the sliding fork completely withdrawn against the handle. The container is then filled with gravel or ballast to the required amount, which is ejected into the cavity *a* by vigorously actuating the sliding fork several times. As the fork is flexible,



the prongs, with their facets 10 can come into contact with the side wall of the cavity at *p*. In this manner the cavity is not only filled, but the material is rammed home, and a uniform fly-packing is obtained throughout the width of the sleepers, which are now allowed to settle, and take up the positions they will occupy permanently. —(*Accepted August* 15, 1935.)

COMPLETE SPECIFICATIONS ACCEPTED

429,411. Hasler Akt.-Ges. vorm. Telegraphenwerkstatte von G. Hasler. Train-carried devices for automatically recording different signal aspects.

429,608. Lawton, J. J. Railway rail joints.

429,658. Vereinigte Eisenbahn-Signalwerke Ges. Apparatus for the counting of train axles.

429,696. Naamlooze Vennootschap Machinerieen-en Apparaten Fabrieken Meaf. Railway level-crossing signals.

429,721. Westinghouse Brake & Saxby Signal Co. Ltd. Pressure regulators.

429,817. Westinghouse Brake & Saxby Signal Co. Ltd. Fluid-pressure braking-apparatus.

429,844. Master, S. D. Fluid-pressure transmission apparatus for driving locomotives and motor vehicles and for other purposes.

429,888. Huguenin, A. Wheel for railway vehicles.

429,896. Thornton, A. A. (Bochumer Verein für Gubstahlfabrikation Akt. Ges.). Vehicle wheels, more particularly one-piece disc wheel for rail vehicles.

429,930. Brown, D. F., and Westinghouse Brake & Saxby Signal Co. Ltd. Pneumatically - actuated control mechanism.

429,975. Turton, Platts & Co. Ltd., G., and Cowen, J. C. Keys for securing railway rails to rail chairs.

430,254. Kershaw, A. G., and Westinghouse Brake & Saxby Signal Co. Ltd. Electric detector mechanism for track points for railways and the like.

XUM

CONTRACTS AND TENDERS

D. Wickham & Co. Ltd. has received an order from the Cie Française des Chemins de fer de la Province de Santa Fé for nine standard petrol-driven gang trolleys complete with canopies.

Large L.M.S.R. Road Vehicle Orders

The L.M.S.R. announces the placing of orders with British manufacturers for nearly 900 new road vehicles. These orders, which comprise the L.M.S.R. programme for the present year, have been made with the two-fold object of improving the company's existing fleet of road vehicles, and making provision for increasing traffic requirements. Details of the orders are as follow.

ASSOCIATED EQUIPMENT CO. LTD.:
Two 14-ton articulated eight-wheeled Matador tractor units with Gardner engines and Carrimore attachments with 22-ft. bodies complete.

ALBION MOTORS LIMITED:
Two 5-ton model 520 chassis with Gardner 4LW. engines, fitted with L.M.S.R. cabs and bodies in L.M.S.R. works.
Five 5-ton model K.52 petrol chassis, fitted with cabs and bodies in L.M.S.R. works.
Four 4-ton model K.52 chassis with Gardner engines, fitted with cabs at L.M.S.R. works and steel moving floor bodies by the Transport Engineering Co. Ltd.
One 5-ton model KL.530 chassis with Gardner engine, complete with cab and 20-ft. body.
One 4-ton model K.52 petrol hand-operated tipping lorry complete.

DENNIS BROS. LTD:
34 2-ton normal control chassis and cabs, fitted with flat bodies in L.M.S.R. works.
Two 2-ton normal-control chassis and cabs fitted with moving rubber floor bodies by Principality Wagon Works Limited.
Three 2-ton forward control chassis with parcels van bodies complete.

FORD MOTOR COMPANY:
10 157-in. Fordson chassis with cabs, fitted with flat bodies in L.M.S.R. works.
Three 131-in. Fordson B.B. chassis fitted with parcels van bodies in L.M.S.R. works.
16 1-ton Ford chassis fitted with parcels van bodies in L.M.S.R. works.
Two 2-ton Fordson tipping lorries complete.
Two 2-ton Fordson trucks complete.

JOWETT CARS LIMITED:
11 10-cwt. light parcels vans complete.
One 10-cwt. lorry complete.

KARRIER MOTORS SUCCESSORS LIMITED:
61 3-ton Cob Junior mechanical horse tractors.

MORRIS COMMERCIAL CARS LIMITED:
One Model C.2 chassis with pantechnicon body complete.
Two Model C.2 tractors with Brockhouse Pullmore semi-trailers.

RALEIGH CYCLE COMPANY:
11 8-cwt. three-wheeled light vans complete.

SCAMMELL LORRIES LIMITED:
39 6-ton mechanical horse tractors.
100 3-ton mechanical horse tractors.
67 6-ton M.H. flat platform trailers.
Seven 6-ton M.H. parcels van trailers.
Six 6-ton M.H. low-loading drop-frame trailers.
Two 6-ton M.H. low-loading drop-frame trailers with covered top and winch.
10 3-ton M.H. low-loader flat platform trailers.
One 3-ton M.H. drop-frame, low-loading trailer.

L.M.S.R. WOLVERTON WORKS:
73 3-ton covered-top mechanical horse trailers with Scammell coupling gear.
Four 3-ton flat mechanical horse trailers with detachable sides and Scammell coupling gear.
One 3-ton covered low-loading mechanical horse trailer with Scammell coupling gear.

METROPOLITAN-CAMMELL WEYMANN BODIES LIMITED:
210 3-ton mechanical horse flat trailers with Scammell coupling gear.

CHAS. ROBERTS & CO. LTD.:
42 4-ton four-wheeled trailers.
25 5-ton four-wheeled trailers.

R. A. LISTER & SONS LTD.:
Three Auto trucks for works.

LANSING, BAGNALL & CO. LTD.:
Four Imp tractors for works.

MERCURY TRUCK & TRACTOR CO. LTD.:
Three Mercury tractors for works.

The English Steel Corporation Limited has received an order from the Bengal-Nagpur Railway for 800 steel tyres for carriages and wagons.

The Crown Agents for the Colonies have recently placed the following orders :—

Vacuum Oil Co. Ltd. Axle oil.
P. & W. MacLellan Limited : 200,000 gall. tank : and bridge materials.
Chas. Roberts & Co. Ltd. : Bogie oil fuel tank wagon.
Cleveland Bridge & Engineering Co. Ltd. : Bridgework.
British Metal Corporation Limited : Copper ingots.
Shropshire Iron Co. Ltd. : Copper wire.
J. Stone & Co. Ltd. : Electrical fittings for caboose coaches.
Ruston & Hornsby Limited and General Electric Co. Ltd. : Oil engine-driven electric generating sets.
Steel Peech & Tozer Limited : Locomotive tyres.
Albion Motors Limited : Lorry chassis.
British (Guest Keen Baldwins) Iron & Steel Co. Ltd. and United Steel Cos. Ltd. : Rails and fishplates.
Motherwell Bridge & Engineering Co. Ltd. : Steelwork.
Brown Bayley's Steel Works Limited, and J. Baker Bessemer Limited : Steel tyres.
Paterson Engineering Co. Ltd. : Water-softening and filtration plant.

Additional Turntables for L.M.S.R.

Cowans, Sheldon & Co. Ltd. has received a repeat order from the L.M.S.R. for eight articulated locomotive turntables, four of which are to be 70-ft. diam. and the remainder 60-ft. diam. These turntables will be of the Vogele type, similar to others installed at a number of L.M.S.R. depots and supplied to other railway companies by Cowans, Sheldon & Co. Ltd. and constructed under licence by Cowans Sheldon. These above turntables will all be fitted with Cowans Sheldon's patent vacuum-operated turning gear.

Cowans, Sheldon & Co. Ltd. has also received an order from the L.M.S.R. for 70 Cowans Sheldon patent vacuum-operated turning gears, to be applied to existing turntables on all parts of the L.M.S.R. system.

B. & S. Massey Limited has received an order from the Bengal-Nagpur Railway for one 40-cwt. steam hammer.

J. Baker & Bessemer Limited has received an order for 60 locomotive tyres, 60 carriage and wagon tyres, and 50 locomotive axles for the Central Argentine Railway.

Railway & General Stores Contractors Limited has received orders from the South Indian Railway, to the inspection of Messrs. Robert White & Partners for 36 tons of metals including tin and lead.

The Indian Stores Department has placed orders with Guest, Keen, Williams Limited for 35 broad gauge 15 ft. 6 in. switches at total price of Rs. 12,355 free delivery ; and with Burn & Co. Ltd. for 55 broad gauge 1 in 8½ crossings at a total price of Rs. 17,765, free delivery.

Webster & Bennett Limited has received an order from the Buenos Ayres Great Southern Railway for one motor-driven 36-in. boring and turning mill.

The electrification of the Cracow suburban railways, it is believed in Warsaw, states a Reuters message, may be carried out by the Metropolitan-Vickers Electrical Co. Ltd., but, the message adds, it has not yet been confirmed that the British firm has obtained the contract.

The West Bromwich Spring Co. Ltd. has received an order for 3,000 volute springs for the Bengal-Nagpur Railway.

G.W.R. Maintenance

During the next twelve months, 406 miles of G.W.R. line are to be relayed completely or renewed in part. Most of the work, especially that on the main line routes, will be carried out during the winter and spring, with the minimum of interference to the travelling public. The work will involve the use of the following materials :—30,200 tons of new rails ; 16,500 tons of cast iron chairs ; 5,160 tons of bolts and fishplates ; 5,100 loads of crossing timbers ; 623,000 sleepers ; 198,000 cubic yards of ballast ; and 2,750,000 keys. In addition, the general maintenance of stations, works, and structures will be undertaken, a special feature being the reconstruction wholly, or in part, of about 50 bridges.

Bochumer Verein A.G. has received an order from the Assam-Bengal Railway for 300 carriage and wagon tyres to the inspection of Messrs. Rendel, Palmer & Tritton.

Kitchen & Wade Limited has received an order for five motor-driven and one belt-driven 37-in. radial drilling machines for the Buenos Ayres Great Southern Railway.

Beyer, Peacock & Co. Ltd. has received an order from the Madras & Southern Mahratta Railway for one 20-ton hand-power screw press for bushes, for running shed use.

The Egyptian State Railways Administration has placed the following orders :—

P. & W. MacLellan Limited : Mild steel black sheets.
The London Plywood & Timber Co. Ltd. : Birch wood panels.
James Dougall & Sons Ltd. : Firebricks.
A. Balfour & Co. Ltd. and Bochumer Verein A.G. : Steel.
Hackethal-Draht Und Kabelwerke : Enamelled and cotton core cable.
H. J. Skelton & Co. Ltd. : Mild steel.
Metal Traders Limited : Copper ingots.

The Egyptian State Railways Administration invites tenders, receivable at the General Management, Cairo, by December 16, for four turret lathes.

The Bengal-Nagpur Railway Administration invites tenders, receivable by November 8, at 132, Gresham House, Old Broad Street, London, E.C.2, for 4,000 steel boiler tubes.

GLYN VALLEY TRAMWAY CO. LTD.—At an extraordinary general meeting of this company, held at Chester on October 7, under the chairmanship of Mr. H. Dyke Dennis, the following extraordinary resolution was passed : "That it has been proved to the satisfaction of this meeting that the company cannot, by reason of its liabilities, continue its business, and that it is advisable to wind up the same, and accordingly that the company be wound up voluntarily ; and that George Henry Haswell, of the city of Chester, chartered accountant, be appointed liquidator for the purpose of such winding-up."

OFFICIAL NOTICES

H.E.H. The Nizam's State Railway

APPLICATIONS are invited for the post of Boiler Shop Foreman on this railway in the State of Hyderabad, India.

Qualifications.

1. Age 30 to 40 years.
2. A good general education.
3. Applicants must have served a regular apprenticeship as a Boiler Maker with a British Railway and have had about 10 years' subsequent practical experience in the Boiler Shop of a British Railway on general locomotive boiler repair work. A thorough knowledge of working drawings on modern locomotives and boiler repair practice essential. Theoretical knowledge of boiler construction is also required. Applicants with a knowledge of pneumatic tools, electric welding and machine practice as applicable to boiler work preferred.

Salary.

According to qualifications, in the grade Osmania Sicca Rupees 460—25—585. (Osmania Sicca rupees are the currency of the Hyderabad State. The rate of exchange is not guaranteed, but ordinarily varies from O.S. Rs. 113 to O.S. Rs. 117 per 100 British India rupees.)

Applications (by letter only) stating age, whether married or single, and giving full particulars of qualifications, training and experience, with *copies* of testimonials, should be addressed to the undersigned not later than 7th November, 1935.

F. ADAMS,
Secretary.

H.E.H. the Nizam's State Railway Board,
269, Winchester House,
Old Broad Street,
London, E.C.2.

29th October, 1935.

Bengal-Nagpur Railway Company Limited

THE Directors are prepared to receive Tenders for :—

4,000 STEEL BOILER TUBES.

Specification and Form of Tender can be obtained at the Company's Offices, 132, Gresham House, Old Broad Street, London, E.C.2, on or after Tuesday, 29th October, 1935.

A fee of 10s. will be charged for each copy of the Specification, which is NOT returnable.

Tenders must be submitted not later than NOON on Friday, 8th November, 1935.

The Directors do not bind themselves to accept the lowest or any Tender, and reserve to themselves the right of reducing or dividing the order.

By Order of the Board,
T. R. WYNNE,
Managing Director.

Universal Directory of Railway Officials and Railway Year Book

41st Annual Edition, 1935-36

Price 20/- net.

This unique publication gives the names of all the principal railway officers throughout the world, together with essential particulars of the systems with which they are connected. Much general and statistical information about railways is also concisely presented.

THE DIRECTORY PUBLISHING CO. LTD., 33, Tothill Street, London, S.W.1.

South Indian Railway Company Limited

THE Directors are prepared to receive Tenders for the supply of :—

1. STEELWORK FOR BRIDGES (Pamban Viaduct);
2. STEELWORK FOR BRIDGES (Villupuram Katpadi Branch).

Specifications and Forms of Tender will be available at the Company's Offices, 91, Petty France, Westminster, S.W.1.

Tenders addressed to the Chairman and Directors of the South Indian Railway Company Limited, marked "Tender for Steelwork for Bridges—Pamban Viaduct," or as the case may be, with the name of the firm tendering, must be left with the undersigned not later than 12 noon on Monday, the 11th November, 1935, in respect of Specification No. 1, and not later than 12 noon on Friday, the 15th November, 1935, in respect of Specification No. 2.

The Directors do not bind themselves to accept the lowest or any Tender.

A charge, which will not be returned, will be made of 10s. for each copy of each Specification.

Copies of the drawings may be obtained at the Offices of the Company's Consulting Engineers, Messrs. Robert White & Partners, 3, Victoria Street, S.W.1.

E. A. S. BELL,
Managing Director.

91, Petty France,
Westminster, S.W.1.
30th October, 1935.

PATENTS for Inventions, Trade Marks, Advice, Handbook, and consultations free. King's Patent Agency, Ltd. (B. T. King, C.I.M.E., Registered Patent Agent, G.B., U.S., and Canada), 146A, Queen Victoria Street, London, E.C.4. 49 years' references. 'Phone City 6161.

RAILWAY AND OTHER REPORTS

Bombay, Baroda and Central India Railway.—At their meeting on Wednesday, October 30, the directors authorised the payment in January next, in addition to the half-year guaranteed interest of £1 10s. per cent., an interim dividend of £1 10s. per cent. in respect of the company's profit for the financial year 1935-36.

Taltal Railway.—A loss on working of £2,642 is shown for the year to June 30, 1935, compared with a loss of £9,135 for 1933-34. The balance brought in was £14,525, and this added to interest, &c., and other credits makes a total of £32,014, enabling a dividend of 2 per cent. to be paid for the whole year, with a balance forward of £5,372. After satisfactory trials of Chilean coal the board has authorised the re-conversion of the company's locomotives and stationary boilers from oil to coal-burning. The total tonnage of goods carried during the year was 119,316 tons, an increase of 18·54 per cent. Passengers increased from 8,308 to 11,912, or 43·38 per cent.

North Eastern of Uruguay Railway.—In their report for the year to June 30, 1935, the directors explain that the value of the Uruguayan dollar in the exchange market has progressively fallen, so that the currency funds of the Central Uruguay Railway Company of Monte Video remitted to London have produced substantially less sterling. Consequently, the scheme of arrangement of 1933, under which payment of one half of the rent due from the Central Company to the North Eastern Company under its lease, was postponed for three years, has now been modified by a further scheme embodying a complete postponement of the payment of the entire rent for one year certain, terminating on September 30, 1936, or for a further year should the stockholders' committee so decide. The board is, therefore, unable to recommend the payment of a balance dividend on the preference and ordinary shares. The re-organisation of the financial structure of this group of companies is under study.

Samana & Santiago Railway Co. Ltd.—Revenue for the year 1934 amounted to £28,413, an increase of £2,165, or 8 per cent., in comparison with 1933. Total expenditure was £25,300, against £24,711, and the operating ratio was reduced from 94·14 per cent. to 89·04 per cent. The credit balance carried to net revenue account was £3,113, against £1,537. Of goods 25,338 tons were carried, an increase of 3,442 tons, and goods receipts rose from £19,426 to £21,024. The profit for the year is £899, compared with a deficiency of £732 in 1933, and the debit balance forward is reduced to £23,202. The freedom from Dominican national and municipal taxation enjoyed by the company under its concession terminated on May 18, 1935, but it is possible that an extension may be granted.

Bengal Dooars Railway.—Gross earnings for the year to March 31, 1935, amounted to Rs. 20,57,011, an increase of Rs. 50,963 over the previous year. Working expenses advanced by Rs. 11,367 to Rs. 11,88,398, and the net earnings of Rs. 8,68,613 were higher by Rs. 39,596. In sterling the net earnings (less Indian taxation)amounted to £57,569, an increase of £3,769. Coaching earnings were lower by Rs. 7,160, but goods traffic receipts improved by Rs. 56,536. The operating ratio was reduced from 58·67 per cent. to 57·77 per cent. From the £85,466 at credit of the net revenue account the directors have placed £10,000 to reserve fund, and recommend a final dividend of 4 per cent. on the ordinary stock, making with the interim dividend of 3 per cent. paid on March 28 last, 7 per cent. for the year, and leaving £59,466 to be carried forward.

Brown Bayley's Steel Works Limited.—The directors have decided to distribute two years' dividend on the 5 per cent. cumulative tax free preference shares, thereby discharging arrears to July 31, 1932.

George Turton Platts & Co. Ltd.—The profit for the year ended July 31, 1935, amounted to £20,183 (against £25,460 for 1933-34). A final dividend of 7½ per cent. is to be paid, making 10 per cent. for the year (the same), and £14,203 is to be carried forward (against £11,539). The turnover would have been greater had not a serious breakdown in the drop stamping department hampered production during a busy period. Orders at the beginning of the new financial year were larger than ever before and as the total output for August and September was considerably in advance of that for the corresponding two months of last year the directors look forward to the coming year with confidence.

XUM

Railway Share Market

The stock and share markets have been moving more irregularly as a result of the impending General Election, in connection with which there is a tendency for markets to "shorten sail," although the Stock Exchange may be said to be estimating for the return of the National Government. Home railway stocks have suffered from restriction of business, but it is reported that buyers come forward with readiness on any offer of stock at much below ruling quotations.

In other words, bargain-hunters appear to be anticipating a general advance in most home railway stocks after the disturbance caused by the holding of an election has passed off. Investors who are inclined to sacrifice their holdings on the view that future prospects have been dimmed by the wages discussions in the railway and coal mining fields, should be prepared to take a similar long view of the situation. The traffic receipts announced on Wednesday were rather above market estimates, but the lack of active interest in markets as a whole prevented the figures exercising any great influence on quotations. Southern preferred ordinary stock has continued to attract investors who require a high yield. The yield on the basis of 4 per cent. dividend is around 5¼ per cent. or fully one per cent. higher than is obtainable on an industrial company's preference stock, and with the additional attraction of a possible increase to 5 per cent. dividends. The L.M.S. 1923 preference stock is regarded as more speculative, but the same company's first preference stock gives a yield of nearly 5¼ per cent. and is estimated to be satisfactorily covered as to its 4 per cent. dividend.

Market interest has this week revived to some extent in the Argentine railway stocks. This is due to the gleam of hope suggested by the recently issued reports and the severity of the comments by the chairmen at the annual meetings on the attitude of the Argentine Government towards the railways. It is hoped that this plain speaking will arouse the Government to the serious results of estranging British capital. Buenos Ayres and Pacific debentures rose on the announcement at Tuesday's meeting of a likely payment of a further two instalments on the second debentures and the Argentine Great Western second debentures. Antofagasta issues made further progress on the pref. dividend payment.

Traffic Table of Overseas and Foreign Railways Publishing Weekly Returns

	Railways	Miles open 1934-35	Week Ending	Traffics for Week: Total this year	Traffics for Week: Inc. or Dec. compared with 1934	No. of Weeks	Aggregate Traffics to Date: Totals: This Year	Aggregate Traffics to Date: Totals: Last Year	Aggregate Traffics to Date: Increase or Decrease	Shares or Stock	Prices: Highest 1934	Prices: Lowest 1934	Prices: Oct. 30, 1935	Yield % (See Note)
				£	£		£	£	£					
South & Central America.	Antofagasta (Chili) & Bolivia	830	27.10.35	15,560	– 2,090	43	530,640	618,470	– 87,830	Ord. Stk.	26 3/4	19	20	Nil
	Argentine North Eastern ..	753	26.10.35	5,723	– 985	17	139,690	132,743	+ 6,947	,,	11	6 7/8	5 1/2	Nil
	Argentine Transandine ..	—	—	—	—	—	—	—	—	A. Deb.	52	45	48	85 16
	Bolivar	174	Sept., 1935	5,000	– 200	39	55,300	54,350	+ 950	6 p.c. Deb.	10	6 1/2	10	Nil
	Brazil	—	—	—	—	—	—	—	—	Bonds.	13 3/4	10 7/16	12 1/2	4
	Buenos Ayres & Pacific ..	2,806	26.10.35	80,846	+ 19,100	17	1,245,283	1,171,795	+ 73,488	Ord. Stk.	16 1/2	8 1/2	6 1/2	Nil
	Buenos Ayres Central ..	190	12.10.35	$106,300	+ $7,600	15	$1,917,400	$1,974,400	– $57,000	Mt. Deb.	23	10	16	Nil
	Buenos Ayres Gt. Southern	5,085	26.10.35	127,673	+ 5,529	17	2,031,805	2,057,924	– 26,119	Ord. Stk.	35	22	16	Nil
	Buenos Ayres Western ..	1,930	26.10.35	37,603	– 1,647	17	664,252	692,805	– 28,553	,,	27 1/2	18 1/2	13	Nil
	Central Argentine	3,700	26.10.35	117,729	+ 19,797	17	2,008,384	2,068,216	– 59,832	,,	23	13 1/2	9	Nil
	Do.	—	—	—	—	—	—	—	—	Dfd.	14	7	5	Nil
	Cent. Uruguay of M. Video	273	26.10.35	9,022	– 11,745	17	143,351	302,045	– 158,694	Ord. Stk.	15 1/2	3	4	Nil
	Do. Eastern Extn.	311	26.10.35	1,280	– 412	17	22,597	25,413	– 2,816	—	—	—	—	—
	Do. Northern Extn.	185	26.10.35	945	+ 105	17	17,545	14,432	+ 3,113	—	—	—	—	—
	Do. Western Extn.	211	26.10.35	776	– 17	17	12,637	11,817	+ 820	—	—	—	—	—
	Cordoba Central	1,218	26.10.35	27,500	+ 1,310	17	532,220	525,760	+ 6,460	Ord. Inc.	6	3	2	Nil
	Costa Rica	188	Aug., 1935	16,672	+ 1,698	9	30,402	33,155	– 2,753	Stk.	30 3/4	23 1/2	34	57 8
	Dorada	70	Sept., 1935	12,200	+ 3,000	39	105,500	90,700	+ 14,800	1 Mt. Db.	103	95	102 1/2	57 8
	Entre Rios	810	26.10.35	9,759	– 1,313	17	201,109	192,771	+ 8,338	Ord. Stk.	21 1/2	12	8	Nil
	Great Western of Brazil ..	1,082	26.10.35	11,100	– 2,900	43	320,700	350,500	– 29,800	Ord. Sh.	7 8	5 8	5 8	Nil
	International of Cl. Amer. ..	794	Aug., 1935	$304,341	+ $32,953	35	$3,265,011	$3,360,090	– $95,079	—	—	—	—	—
	Interoceanic of Mexico ..	—	—	—	—	—	—	—	—	1st Pref.	1/–	1/–	1 2	Nil
	La Guaira & Caracas ..	22 3/4	Sept., 1935	3,560	+ 515	39	34,985	32,865	+ 2,120	Stk.	12 3/4	7 5/8	8 1/2	Nil
	Leopoldina	1,918	26.10.35	20,797	– 3,491	43	764,401	957,643	– 193,242	Ord. Stk.	14 5/8	7	3 1/2	Nil
	Mexican	483	21.10.35	$241,200	+ $27,700	16	$3,940,300	$3,541,200	+ $399,100	,,	3 1/4	1 1/2	1 2	Nil
	Midland of Uruguay ..	319	Sept., 1935	5,195	– 3,107	13	15,846	25,851	– 10,005	,,	1 1/2	1 2	1 1/2	Nil
	Nitrate	401	15.10.35	7,703	+ 3,783	41	117,857	104,803	+ 13,054	Ord. Sh.	3 29/32	51/–	2 1/4	Nil
	Paraguay Central	274	19.10.35	$1,779,000	+ $857,000	16	$30,880,000	$15,500,000	+ $15,380,000	Pr. Li. Stk.	84	67	77 1/2	7 1/4
	Peruvian Corporation ..	1,059	Sept., 1935	69,275	+ 5,502	13	217,772	186,438	+ 31,334	Pref.	14 1/2	8	9 1/2	Nil
	Salvador	100	19.10.35	¢10,979	+ ¢2,947	16	¢189,521	¢150,023	+ ¢39,498	Pr. Li. Db.	75	70	65	7 11/16
	San Paulo	1531/2	20.10.35	25,530	– 645	42	1,069,562	1,141,975	– 72,413	Ord. Stk.	86	67	40	6 1/4
	Taltal	164	Sept., 1935	4,305	+ 2,470	13	9,250	6,913	+ 2,337	Ord. Sh.	2 1/8	1 7/16	1 3/8	7 1/4
	United of Havana	1,353	26.10.35	14,192	– 733	17	277,830	284,899	– 7,069	Ord. Stk.	6	2	2	Nil
	Uruguay Northern	73	Sept., 1935	580	– 661	13	1,762	3,312	– 1,550	Deb. Stk.	6 1/4	3	4 1/2	Nil
Canada.	Canadian National	23,697	21.10.35	789,939	+ 66,349	42	27,430,329	26,427,817	+ 1,002,512	—	—	—	—	—
	Canadian Northern ..	—	—	—	—	—	—	—	— 4 p.c.	Perp. Dbs.	78 1/4	51 1/2	59 1/2	6 3/4
	Grand Trunk	—	—	—	—	—	—	—	—	4 p.c. Gar.	104 1/2	97 1/4	97 1/2	4 1/2
	Canadian Pacific	17,224	21.10.35	632,200	+ 39,000	42	20,382,800	19,847,200	+ 535,600	Ord. Stk.	18 5/16	11 1/16	9 1/2	Nil
India.†	Assam Bengal	1,329	10.10.35	35,527	– 4,940	27	628,383	738,115	– 109,732	Ord. Stk.	88 1/2	72	78 1/2	3 15/16
	Barsi Light	202	30.9.35	2,730	+ 23	26	70,980	75,082	– 4,102	Ord. Sh.	10 4 1/2	98 3/4	80 1/2	6 5/16
	Bengal & North Western ..	2,114	30.9.35	53,400	+ 4,841	26	1,213,202	1,215,343	– 2,141	Ord. Stk.	297 1/2	262	294 1/2	5 7/16
	Bengal Dooars & Extension	161	30.9.35	4,459	– 1	26	64,806	73,406	– 8,600	,,	125 1/4	124	122 1/2 5/8	5 11/16
	Bengal-Nagpur	3,268	10.9.35	147,225	+ 4,254	22	2,807,897	2,608,739	+ 199,158	,,	105 1/2	96	101 1/2	3 15/16
	Bombay, Baroda & Cl. India	3,072	20.10.35	235,575	+ 19,650	28	4,273,425	4,281,900	– 8,475	,,	115	108 1/2	112 1/2	5 5/16
	Madras & South'n Mahratta	3,230	30.9.35	133,350	– 5,605	26	2,678,210	2,958,791	– 280,581	,,	131	122 3/4	120 1/2	7 8
	Rohilkund & Kumaon ..	546	30.9.35	10,576	+ 459	26	231,774	240,434	– 8,660	,,	263	250	292 1/2	5 8
	South India	2,526	10.10.35	114,611	– 15,540	27	2,148,961	2,262,265	– 113,304	,,	119	115	112 1/2	6 11/16
Various.	Beira-Umtali	204	Aug., 1935	69,967	+ 1,369	48	710,272	587,777	+ 122,495	—	—	—	—	—
	Bilbao River & Cantabrian	15	Sept., 1935	1,160	– 695	39	13,358	16,195	– 2,837	—	—	—	—	—
	Egyptian Delta	622	10.10.35	8,919	+ 1,220	27	111,419	112,871	– 1,452	Prf. Sh.	21 3/16	15 4	11 2	6 11/16
	Great Southern of Spain ..	104	19.10.35	1,465	– 1,050	42	73,791	92,805	– 19,014	Inc. Deb.	4	3 1/2	3 1/2	Nil
	Kenya & Uganda	1,625	Sept., 1935	166,857	+ 17,443	39	1,808,941	1,694,916	+ 114,025	—	—	—	—	—
	Manila	—	—	—	—	—	—	—	—	B. Deb.	50	33	37	9 7/16
	Mashonaland	913	Aug., 1935	117,688	– 2,319	48	1,277,362	1,076,622	+ 200,740	1 Mg. Db.	101	91 3/4	101 1/2	4 15/16
	Midland of W. Australia ..	277	Aug., 1935	12,044	– 2,011	9	23,052	25,952	– 2,900	Inc. Deb.	100	93	94 1/2	5 5/16
	Nigerian	1,905	7.9.35	16,947	– 1,687	23	527,724	590,633	– 62,909	—	—	—	—	—
	Rhodesia	1,538	Aug., 1935	203,069	+ 5,376	48	2,125,732	1,808,818	+ 316,914	4 p.c. Db.	104 7/8	97 1/2	104	3 15/16
	South African	13,225	5.10.35	594,004	+ 85,765	27	14,890,128	13,482,936	+ 1,407,192	—	—	—	—	—
	Victorian	4,728	July, 1935	713,389	+ 20,391	4	713,389	692,998	+ 20,391	—	—	—	—	—
	Zafra & Huelva	112	Aug., 1935	12,102	+ 955	35	88,575	88,009	+ 566	—	—	—	—	—

NOTE.—Yields are based on the approximate current prices and are within a fraction of 1/16

† Receipts are calculated @ 1s. 6d. to the rupee. § ex dividend. Salvador and Paraguay Central receipts are in currency

The variation in Sterling value of the Argentine paper peso has lately been so great that the method of converting the Sterling weekly receipts at the par rate of exchange has proved misleading, the amount being over estimated. The statements from July 1 onwards are based on the current rate of exchange and not on the par value

Diesel Railway Traction

The Economy of Large Diesel Locomotives

DESPITE the numbers in which diesel railcars and light locomotives are being set to work, the high-power diesel locomotive is making but slow headway. In this range there must still be numerous examples in which the adoption of a diesel locomotive definitely would not pay, and to build a unit which might conceivably pay if it were taken under the wing of the gods, is not merely wasted effort—it is derogatory to diesel traction as a whole. The principle and application of oil engines to railway work is a science quite strong enough to stand alone on its merits without any bolstering by the suppression of unfavourable results or efforts to make a better showing than has actually been accomplished. For this reason we recommend a study of the lectures read at the Purdue University by Mr. A. I. Lipetz, and abstracted in this issue. Mr. Lipetz shows for certain conditions just when a diesel locomotive will be an economical proposition, and stresses the effect of the first cost upon the ultimate economy. The importance of this is paramount for main line work, as may be appreciated by briefly considering the cost of recent main line locomotives, viz., £73,000 for the 3,600 b.h.p. unit on the Atchison Topeka & Santa Fé Railroad and £52,500 for two 1,300 b.h.p. locomotives on the North Western Railway of India. It is only the peculiarly difficult conditions of working which enable these locomotives to show a saving over steam working after all capital charges have been met.

Diesels at Nuremberg Exhibition

THE extraordinarily interesting railway exhibition (now closed) organised by the Reichsbahn at Nuremberg to commemorate the centenary of railways in Germany, contained a dozen exhibits, including the Flying Hamburger, which was temporarily withdrawn from service to figure at the Exhibition after it had covered 200,000 miles in service. During the summer its place on the Berlin-Hamburg route was taken by one of 13 double-car units delivered during the past year. One of these new 820 b.h.p. sets was not on view at Nuremberg, but there was one of the even newer 1,200 b.h.p. triple-car diesel trains, but without its power unit. After this, the largest exhibit was the 1,300 b.h.p. diesel-hydraulic locomotive with a supercharged M.A.N. engine, which has been constructed to the order of the Reichsbahn for trial purposes. Of the types which have been tried in service, the largest exhibit was one of the standard two-car sets comprising a 410 b.h.p. Maybach double-bogie railcar coupled to a driving trailer. The numerous smaller diesel cars running on the Reichsbahn were exemplified by a 150 b.h.p. four-wheeled car with geared drive and an M.A.N. engine, which is used on the Bavarian division, and a similar car with Voith hydraulic transmission and Mylius axle drive. Finally, there were five of the standard Reichsbahn diesel locotractors built by different makers. Three of these have geared transmission with the final drive through chains; one is fitted with the Voith hydraulic gear; and the third is driven by an exhaust-gas transmission.

The Riding of High-Speed Railcars

NUMEROUS changes from the accepted practice of electric traction have been made in the suspension and bogie design of single and articulated diesel cars, and at first sight it appears that the valuable experience gained with electric motor-coaches has been thrust aside simply in order to be able to mount the engine on the bogie or find room for unnecessarily cumbrous transmission constituents or auxiliaries. The design of the railcar as a whole is made up of a number of compromises, but we think there have been too many cases in which a railcar has been built round a given engine or transmission instead of a power unit installed in a railcar. Even with a bogie-mounted engine, and consequently an appreciable change in the bogie design compared with electric practice, it is possible to get a very smooth riding vehicle, *e.g.*, the new two-car diesel sets of the Reichsbahn working the Fliegende Kölner and Fliegende Frankfürter services. At the same time, these bogies have to be kept up to scratch or the riding deteriorates considerably, and this may be the reason why the bogie-mounted engine is not so popular in Germany as it was. Non-bolster bogies are typical of diesel railcars, but for single vehicles running at speed it is questionable whether the arrangement of the engine is of sufficient importance to warrant a secondary standard in the riding. Certainly if railcar traction progresses at the rate maintained during the last two years the matter will have to be given more attention, for the defects in the riding will be brought before the notice of an increasing number of people. The French authority, Marié, pointed out that a vehicle is stable on a given track at a given speed when it offers great resistance to derailment and overturning, and is comfortable when the various oscillations of the spring-borne weight result in reasonable accelerations which do not persist in the passenger saloons. He stressed further the necessity for providing appreciable resistance to lateral movement, and the desirability of introducing some form of damping friction to absorb any resonance set up by hunting. These requirements, if not lost sight of altogether, have been subordinated in many railcars to other requirements not concerned with the riding or, indeed, with any part of the mechanical portion. An exception to this is the Brill bogie fitted to the railcars of the Congo-Ocean Railway described in the issue of this Supplement for September 7, 1934, and to certain light railcars in France. The feature of this bogie is that the body and bogie bolster are mechanically linked together in a manner which prevents relative transverse motion while allowing complete freedom of movement in the vertical direction. The question of articulation needs most careful consideration. Two-car units ride with notable steadiness, but with six and seven-car trains articulated either as one unit or as three, the reverse is apt to be the case, more particularly at the tail end of the train. Three-car units appear to give some trouble at speeds over 85-90 m.p.h., but experience gained has shown that not all of the rough riding is due to articulation, and some improvement in the behaviour of the Burlington Zephyr trains has resulted from a modification of the tyre profile. Other high-speed diesel trains also have a flatter cone on the tyre treads.

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THE POTENTIALITIES OF DIESEL TRACTION

A critical study of shunting and main-line applications

*By A. I. LIPETZ, Consulting Engineer, American Locomotive Company**

IN order to be successful, a locomotive must have the following qualities, which are enumerated below in order of their descending relative importance:—

(1) Reliability.
(2) Simplicity.
(3) Availability.
(4) Economy.

Reliability means that a locomotive should not get unduly out of order while hauling trains. The failure of a locomotive in service, causing delay to trains and disorganisation of traffic costs the railway company a sum that more than offsets ordinary economy in the operation of dozens of locomotives. Therefore, should an economical diesel locomotive have many complicated accessories and auxiliaries which are liable to get out of order and cause breakdowns on the road, it will not be acceptable to the company.

Simplicity means two things; simplicity of operation, and simplicity as regards maintenance. The first implies that there should not be on the locomotive too many handles, valves, gauges and other parts that would require the driver's attention and tax his skill beyond what is expected of an ordinary engine driver. If the new design calls for an additional operation by means of a handle or valve, it should be made automatic, provided that such automatic action is reliable.

As to simplicity regarding maintenance, it is partly connected with *availability*, which means that the engine should require very little time for standing idle in the terminal and running sheds. If a complicated, although maybe a very ingenious and economical machine, needs frequent attention, fuelling and cleaning, replacement of parts that requires much time, and so on, the availability is low. It is measured by the percentage ratio of the average number of hours when the locomotive is able to perform work, to the number of hours of offered work. In some cases diesel locomotives have an availability close on 100 per cent.; for instance, if in a certain freight yard there is sufficient work for one locomotive for 24 hr. one diesel locomotive is sufficient—it will work with three crews (three shifts of eight hours each).

Economy of operation is self-explanatory. It is usually a sum total of several items, namely, economy in fuel, lubrication, water, and maintenance, &c.

Very closely connected with the above, especially with availability, is the question of first cost. Ordinarily, if a locomotive has operating advantages it is more expensive; otherwise there would be no question about giving it preference—the new locomotive would very soon replace the old one. It is therefore usually a question of balancing fixed charges (interest and depreciation) resulting from the larger investment against economy and other operating advantages.

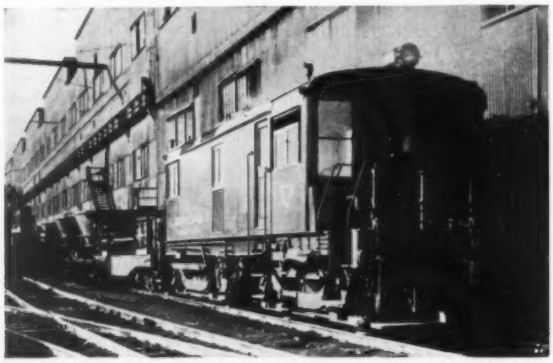
Shunting Considerations

An example will better illustrate the point. Suppose that at a certain station or freight yard there is sufficient switching work to keep at least one locomotive busy 24 hr. a day, and that a steam locomotive can do the work at a total operating cost of $5·00 an hour including crew wages, fuel, and cost of lubrication and maintenance, while the diesel locomotive can do the same work for $3·00 an hour; in other words, that the economy of operation amounts to $2·00 an hour. These figures check up with information supplied by nine railways on the performance of their diesel locomotives, and checked against more recent data.

Suppose, further, that the cost of a new diesel locomotive of the power necessary to do the work, say 600 b.h.p., would cost $75,000, while the steam locomotive can be acquired at a price of $35,000 (also new). Assume that the rate of depreciation is 6 per cent. for either locomotive (this figure is not very favourable to the steam locomotive, for which some railways consider 4 per cent. sufficient), and also assume the usual interest charges of 6 per cent. for both locomotives, making a total of 12 per cent. for both the steam and the diesel locomotive. The fixed charges thus amount to $350 and $750 a month respectively.

In working 24 hr. a day, or 720 hr. a month, a diesel locomotive is putting in actually 700 hr., corresponding to an availability of 700/720, or 97·2 per cent., the remaining 2·8 per cent. being spent on taking fuel and

* In a symposium of lectures delivered at Purdue University.



400 *b.h.p. diesel-electric shunter at a steel mill*

American oil-electric-battery shunting locomotive

water, weekly and monthly inspection, changing lubricating oil once in three months, &c. Let it be assumed first that a steam locomotive would not require more time for similar operations; in other words, that only one steam locomotive would be required instead of one diesel locomotive. Then the overall economy in operation per month would be:—

Cost of operation, less for the diesel	.. 2×700	= \$1,400
Fixed charges, more for the diesel	.. $750 - 350$	= \$ 400
Economy in favour of the diesel locomotive		\$1,000

Actually, the steam locomotive cannot work 700 hr. a month. It requires more time for taking fuel than the diesel locomotive, especially if it is a coal-burner, and also more time for taking water. It needs time for cleaning the firebox and ash-pan, for periodic inspection and washing out of the boiler, and for repairs. From experience so far gained, the availability of the switching steam locomotive is about 525 hr. a month, or 525/720

300 *b.h.p. Alco-engined shunter on the Lehigh Valley Railroad*

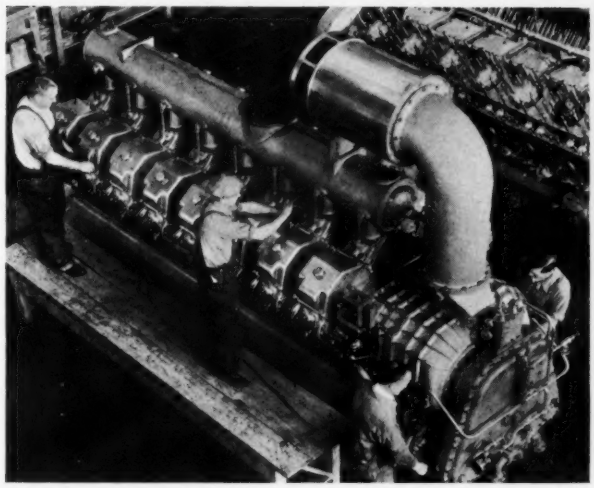
= 72·8 cent., about three-quarters that of the diesel locomotive. If there should be only 525 hr. work a month in a station, or about 18 hr. a day, not more than one steam or one diesel locomotive would be required, and the overall economy per month would be in accordance with the figures given below.

Cost of operation, less for the diesel	.. 2×525	= \$1,050
Fixed charges, more for the diesel	..	= \$ 400
Economy in favour of the diesel locomotive per month, as the fixed charges are the same per year, and do not depend upon the utilisation of the locomotive	..	\$ 650

However, if the amount of work in the station should be more than 525 hr. a month, more than one steam locomotive would be required and the investment for steam power would be increased. For 700 hr., for instance, one diesel locomotive would be still sufficient, but two steam locomotives would be necessary. Then the balance sheet for a month would have to be made up as follows:—

Cost of operation, less for the diesel	.. 2×700	= \$1,400
Fixed charges, more for the diesel	.. $750 - 2 \times 350$	= \$ 50
Economy in favour of the diesel locomotive a month		= \$1,350

Thus the economy will vary between \$650 and \$1,350 a month, representing an additional return on the investment, after interest and depreciation have been deducted. The higher figure of economy corresponds to the complete utilisation of the diesel locomotive as the case usually is with respect to expensive equipment. A question may arise as to whether the availability of the diesel locomotive has not been taken at too high a figure (97·2 per cent.).



1,200 *b.h.p. Winton two-stroke engine as used in American main-line trains*

It is true that this figure, based on actual experience, applies so far to new diesel locomotives, and that when the locomotives undergo general repairs the figures may have to be slightly reduced. However, the ratio of the two availabilities (of the steam locomotive to that of the diesel), which has been assumed to be 3:4, for the sake of even figures for the calculations, will remain about the same.

Relative Costs of Diesel and Steam Operation

Fig. 1 represents a chart of diesel locomotive operation cost compared with that of steam for the case when both diesel and steam locomotives are new. The difference in operating cost is taken as above, *i.e.*, \$2·00 per hr. in favour of the diesel. The cost of each of the two locomotives and their respective availabilities are as previously assumed; as before, the fixed charges were figured to be identical for diesel and steam—6 per cent. interest and 6 per cent. depreciation. The abscissæ represent locomotive hours per month in a switching or classification yard, while the ordinates are savings in dollars per month. The upper straight line is the saving in operation cost without taking into consideration fixed charges on investment. The step line below the zero horizontal line represents the difference in fixed charges of the diesel locomotives as compared with steam. The number of locomotives of each kind needed for the amount of work in the yard is marked below the lower step line. The net saving, after the difference in fixed charges is deducted from the saving in operation, is shown by the upper step line.

The chart shows that when only one diesel locomotive is placed in service in a yard, and when it is utilised less than 200 hr. a month, such a locomotive does not bring about a saving in cost. As soon as the work of the diesel locomotive goes up, however, a saving is effected. The savings go up with the increase in work and with the increase in the number of locomotives, which is only natural.

Fig. 2 differs from Fig. 1 in that the diesel locomotives are assumed to be new and fully paid for, calling for high fixed charges, while the steam locomotives are old, with their first cost written off, and therefore have no fixed charges. Such a comparison is most unfavourable to the diesel locomotive. In order to make it still more unfavourable the saving in operation cost has been reduced from \$2·00 to \$1·20 an hour, which is about the minimum that can ever be expected. This

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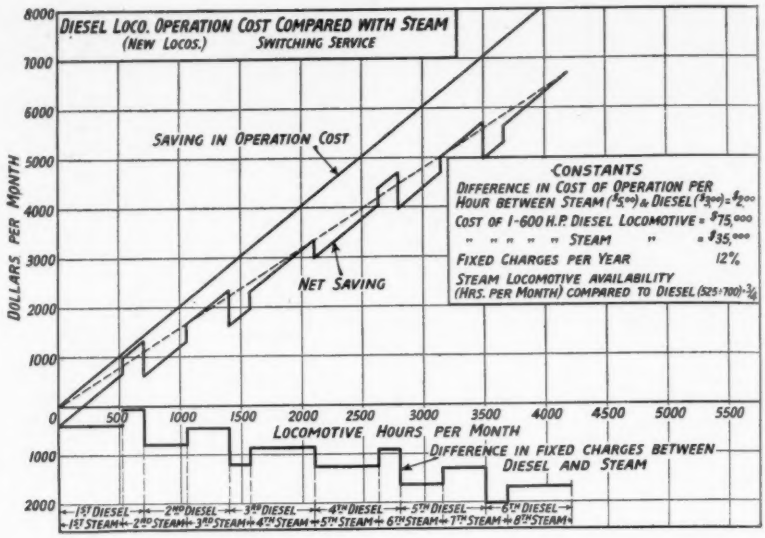

Fig. 1—Chart showing comparative costs of operation (including capital charges) of steam and diesel-electric shunting locomotives, assuming new units in each case

corresponds to a high cost of oil (6 cents per U.S. gal.) for the operation of the diesel locomotives, compared with low cost of coal ($1·75 per short ton) for the steam locomotives. The chart shows that under these conditions the economy in operation is still able to offset the fixed charges of the diesel locomotives. In other words, only under the most unfavourable conditions, when the railway has old locomotives which are still in a condition that does not call for an increased maintenance, when coal is cheap, and oil is expensive (this does not happen very often in the same territory), the diesel locomotive does not show economy in switching operation. In all other cases, which are all the practical cases in existence, the diesel locomotive shows very marked economy.

It has also to be remembered that there are indirect savings due to dieselisation, such as the elimination of coal stations, water columns, and ash pits. These savings sometimes make the use of one diesel locomotive worth while at a remote station with little work. The savings, however, go up with the increase in work, especially if the whole switching or classification yard with a number of steam locomotives can be turned over to exclusive operation by diesel locomotives.

The Diesel for Heavy Main-Line Work

On Fig. 1 a straight dotted line is shown. It passes through the points which correspond to complete utilisation of both steam and diesel locomotives, depending upon the amount of work in the yard; 2,100 loco-hours are just sufficient for four steam or three diesel locomotives, or 4,200 loco-hours for eight steam or six diesel locomotives, and so on. This line represents approximately the saving in all cases without going into details of the step lines. It corresponds to a formula:

$$E = W(C_s - C_d) - (N_d P_d - N_s P_d)\,\frac{f}{1{,}200} \quad .. \quad (1)$$

where E = saving (economy) per month, in dollars
W = work in locomotive hours per month
C_s = cost of operation of steam locomotive in dollars per hr.
C_d = cost of operation of diesel locomotive in dollars per hr.
N_d = number of diesel locomotives required for work W
N_s = number of steam locomotives required for work W
P_d = cost of one diesel locomotive in dollars
P_s = cost of one steam locomotive in dollars
f = fixed charges in per cent. per year, $f = i + d$ (interest + depreciation).

This is a general formula which can be applied to any kind of work, not only switching. It has the advantage that it allows the possibilities of a diesel locomotive to be determined in a simple and quick way. As an example of its application, let us consider the diesel main-line locomotive. The amount of work which has to be done in order to maintain a certain number of trains over a certain division is usually given, or can easily be figured out. Let it be W loco-hours, as above. W depends upon the number of trains, their speeds and the length of the division, and does not depend upon the type of locomotives. Whatever difference there may be between the diesel and steam locomotive in the preparation of the latter prior to taking a train and in the shed after leaving it, will be accounted for in the number of locomotives, as will be seen later. If, for instance, on a stretch of 1,000 miles four freight trains must be operated in each direction, and if the average speed of the trains is 30 m.p.h., the total work in locomotive-miles per month is $2{,}000 \times 30 = 240{,}000$, and in hr. $240{,}000 \div 30 = 8{,}000$. Thus $W = 8{,}000$ loco-hours.

The next thing to determine is the number of locomotives. This depends upon the schedules of the trains, their speeds, the meeting points, and to a certain extent upon the type of locomotives used. It may be expected that under good conditions of traffic a steam locomotive may make as much as 8,000 miles a month in freight service. This means that for the above number of trains 30 steam locomotives are necessary. For diesel locomotives the number will be less, as there will be some saving in time due to the elimination of cleaning fires, water taking, and a reduction in fuelling time.

More important, however, than this is better utilisation. The diesel locomotives will be able to make through runs over divisions on which the steam locomotives have to be changed. The individual runs may be twice as long. However, the utilisation will also depend upon the intervals between return trains at terminals. In some cases it may be found that the utilisation of the diesel locomotive can be made from 20 to 30 per cent. higher than that of the steam locomotives, say, by 25 per cent. more, or to an extent of 10,000 miles a month. For the above example, then, 24 diesel locomotives will be needed.

No figures on the saving in operation cost are available, but some conclusions may still be drawn. The experience with the switching locomotives referred to above, and the published and other available data show that the cost of maintenance of new diesel locomotives is about the same as that of old steam locomotives. This would indicate

that we can hardly expect any saving due to cheaper maintenance of the diesel locomotive; nor can there be any saving in lubrication, as the oil for the diesel engine is more expensive than cylinder and machine oil for the steam engine, and it is doubtful whether this extra cost of lubrication for the diesel engine can be offset by the saving in the cost of the water. The crew of the diesel locomotive cannot consist of a smaller number of men to be paid less than the steam locomotive crew. Therefore if it is assumed that the total saving will be equal to the saving in fuel cost no great mistake can be made, and whatever difference there may be will be in favour of the diesel, rather than the steam locomotive.

Fuel Saving under Main-Line Conditions

In order to work out the possible saving in fuel, consider first the consumption of fuel by locomotives and then the fuel price. For a good sized American freight train running at an average speed of 30 m.p.h., a locomotive of about 3,000 rail h.p. is necessary. In the case of the steam locomotive, an indicated h.p. of $3{,}000/0{\cdot}91 = 3{,}200$ i.h.p. should be developed, the mechanical efficiency of the locomotive engine to the rims of the driving wheels varying from 0·9 to 0·94. In the case of a diesel-electric locomotive, a diesel shaft h.p. of $3{,}000/0{\cdot}75 = 4{,}000$ b.h.p. will be required, as the efficiency of the electric transmission from the diesel engine shaft to the driving wheels, varies between 0·7 and 0·8.

Further, assume that the average rail h.p. in either case (steam or diesel) is two-thirds of the maximum (indicated or diesel b.h.p.) h.p. The small difference in the weights of the locomotives, including the tender of the steam locomotives, can be disregarded in the case of a freight train, as the additional friction of the tender wheels is negligible in comparison with the total resistance of the train. Thus, for the steam locomotive there is an average of $2/3 \times 3{,}200$ i.h.p. while for the diesel an average of $2/3 \times 4{,}000$ engine b.h.p. is given. The best coal consumption of a modern steam locomotive is in the neighbourhood of 2 lb. per i.h.p.hr., depending on the quality of coal. In view of the variation in the load it is assumed that the fuel consumption may go up to 2·5 lb. Further, an increase to 2·75 lb. per i.h.p.hr. has been assumed in view of the necessity of holding the pressure in the locomotives and keeping fire in them in the sheds. Thus, for one steam loco-hr. there is needed

$$2/3 \times 3{,}200 \times 2{\cdot}75 = 5{,}867 \text{ lb., say } 6{,}000 \text{ lb.}$$

In the case of the diesel locomotive, the fuel consumption usually is about 0·4 lb. of oil per b.h.p.hr. at the rated power of the diesel engine. At partial and variable loads the consumption is relatively greater. A round figure of 0·52 lb. of oil will probably represent the actual average consumption, making the total consumption per loco-hr. in U.S. gal. $2/3 \times 4{,}000 \times 0{\cdot}52/7{\cdot}2 = 192{\cdot}6$, or, in round figures, 200 gal.

As to prices for coal and oil, the prices must be referred to the same territory. The lowest price of coal in 1934 was $1·61 per short ton (2,000 lb.) on the Norfolk & Western (Pocahontas region), including freight, and the highest was $4·88 on the Canadian Pacific (in the Vermont-New England region). The average for all regions of the U.S.A. was $2·19 per short ton. As to diesel oil (not boiler fuel oil), the prices in the south-western and mid-western regions was 3·5-4 cents and in New England as high as 6 cents a gallon.

On the above basis the difference in operation cost can be easily figured out. Consider (1) Pocahontas region and (2) New England region. In the first:

$$C_s - C_d = 1{\cdot}61 \times 3 - 0{\cdot}035 \times 200 = 4{\cdot}83 - 7{\cdot}00 = \$2{\cdot}17 \text{ per loco-hour;}$$

In other words, diesel operation is more expensive. For New England:

$$C_s - C_d = 4{\cdot}88 \times 3 - 0{\cdot}06 \times 200 = 14{\cdot}64 - 12{\cdot}00 = \$2{\cdot}64$$

that is, there is a certain economy. This will amount to $2{\cdot}64 \times 8{,}000 = \$21{,}120$ a month, which, nevertheless, cannot cover the fixed charges, as will be seen from the following consideration. The numbers of locomotives which are needed for the work W, given above in the example, were found to be

$$N_s = 30 \text{ and } N_d = 24$$

for steam and diesel locomotives respectively. The cost of the locomotive can be assumed to be about $80,000 for a steam locomotive developing up to 3,200 indicated h.p. and about $350,000 for a diesel locomotive developing 4,000 b.h.p.* Thus, referring to formula (1), we have for the total economy per month due to the dieselisation of the division, if the fixed charges amount to 12 per cent.:—

$$E = 8{,}000 \times 2{\cdot}64 - (24 \times 350{,}000 - 30 \times 80{,}000)\ \frac{12}{1{,}200}$$

$$E = 21{,}120 - (8{,}400{,}000 - 2{,}400{,}000\ \frac{1}{100} = 21{,}120 - 60{,}000 = -38{,}800$$

In other words, the dieselisation of the above division

* The new Atchison Topeka & Santa Fe diesel-electric locomotive of 3,600 b.h.p. cost $360,000, and the 1,300 b.h.p. locomotives for the N.W.R. (India) £26,250 each.—ED.

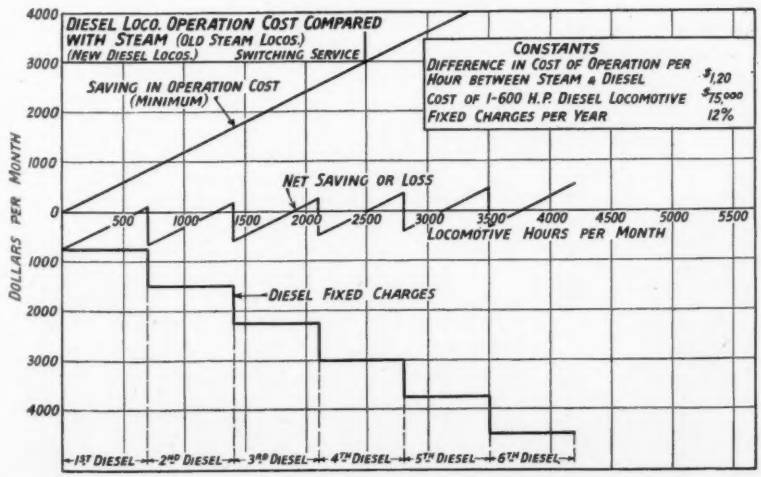

Fig. 2—Chart showing comparative costs of operation (including capital charges) of steam and diesel-electric shunting locomotives, assuming new diesel and old steam machines

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would result in a loss of $38,880 a month under the conditions outlined above.

Utilisation and Economy

The above example has been discussed in detail in order to clarify the different phases of the economy or loss due to dieselisation. For practical purposes it may be advisable to use simplified formulæ which can be derived from formula (1). Denote the utilisation of a steam locomotive, namely, the number of hr. a month when the locomotive is actually pulling trains, by U_s, and correspondingly the utilisation of a diesel locomotive by U_d. Then on a steam-operated division

$$W = N_s \times U_s$$

and in a case of complete dieselisation of the division

$$W = N_d \times U_d$$

consequently

$$K = \frac{N_s}{U_d} = \frac{N_d}{U_s} \quad \ldots\ldots\ldots\ldots\ldots \quad (2)$$

This ratio indicates the improvement in the utilisation of locomotives because it shows the increase in the number of hours of work of a diesel locomotive as compared with steam, and also how many steam locomotives are equivalent to one diesel. In the above example, for instance, $K = \frac{30}{24} = 1{\cdot}25$, we shall call K the "utilisation ratio."

Divide equation (1) by N_d and denote by e the economy in dollars a month resulting from one diesel locomotive. The new equation will be:—

$$e = \frac{E}{N_d} = \frac{W}{N_d}(C_s - C_d) - \left(P_d - \frac{N_s}{N_d} P_s\right) \frac{f}{1{,}200}$$

or

$$e = U_d (C_s - C_d) - (P_d - K P_s) \frac{f}{1{,}200} \quad \ldots\ldots \quad (3)$$

In the previous example the utilisation of one diesel locomotive was

$$U_d = \frac{8{,}000}{24} = 333{\cdot}3 \text{ hr. a month.}$$

Economy in operation cost per hour has been found to be

$$\begin{aligned} C_s - C_d &= \$2{\cdot}64 \\ P_d &= \$350{,}000 \\ P_s &= \$80{,}000 \\ K &= \$1{\cdot}25 \\ f &= 12 \end{aligned}$$

consequently,

$$e = 333{\cdot}3 \times 2{\cdot}64 - (350{,}000 - 1{\cdot}25 \times 80{,}000) \times 0{\cdot}01$$
$$e = 880 - 2{,}500 = -1{,}620$$

or a loss of $1,620 for one diesel locomotive a month. If this is multiplied by 24 the total loss per month is found to be $38,880 for dieselisation of the whole division.

The advantage of formula (3) as compared with formula (1) lies in the possibility of manipulating with smaller figures. The more important advantage is the ease with which special problems can be solved. For instance, e increases with the increase of U_d and K. Assuming first that K remains constant (1·25), an investigation may be made as to how e can be increased and whether it can be made positive instead of negative by increasing U_d, that is, the utilisation of the diesel locomotive.

In the former example U_d was 333·3 hr. a month. The highest any locomotive could reach in 30 days is 720 hr., but that pre-supposes that the locomotive would run all the time without even stopping at terminals to turn round. In view of the fact that schedules do not provide immediate return trains, some loss of time is inevitable, and it would therefore seem impossible to increase U_d above some minimum figure, probably 500 hr. a month. With an average freight train speed of 30 m.p.h., or of a passenger train, 40 m.p.h., the corresponding locomotive mileages would be 15,000 and 20,000 a month, which is about the limit any freight or passenger locomotive actually can accomplish. Using the previous constants we shall have

$$e = 500 \times 2{\cdot}64 - (350{,}000 - 1{\cdot}25 \times 80{,}000) \times 0{\cdot}01$$

or

$$e = 1{,}320 - 2{,}500 = -\$1{,}180 \text{ a month.}$$

Thus the loss is reduced, but it is still a loss. The second multiplier in the first member of the formula, namely, $C_s - C_d$ (the saving in operation cost), may be tried. The figure used heretofore was 2·64, found as a result of comparing the highest price of coal, $4·88 per short ton, with the corresponding price of oil in the New England region 6 cents a gallon. Assume that the market conditions will change, so that oil in New England will cost only 3·5 cents a gallon; then the saving in fuel cost, according to the previous method of calculation, will be

$$C_s - C_d = 4{\cdot}88 \times 3 - 0{\cdot}035 \times 200 = 14{\cdot}64 - 7{\cdot}00 = \$7{\cdot}64$$

an hour, and formula (3) will give:—

$$e = 500 \times 7{\cdot}64 - (350{,}000 - 1{\cdot}25 \times 80{,}000) \times 0{\cdot}01$$

or

$$e = 3{,}820 - 2{,}500 = \$1{,}320$$

saving a month. Only in this hypothetical case (oil 3·5 cents a gallon in New England) can there be a saving, provided the price of coal remains unchanged.

Reverting now to real conditions, it may be calculated whether the increase in the ratio of utilisation, K, can improve the situation of the diesel railway locomotive. For some high-speed passenger trains it is sometimes thought that K can be increased, say to 1·65, meaning that one diesel locomotive (for the same train schedules) will be equivalent to 1·65 steam locomotives. We may formulate the problem in the following way: to find the utilisation ratio K which would make the diesel locomotive at least a self-paying proposition, that is, when $e = 0$; then for the previous constants:—

$$\begin{aligned} e = 500 \times 2{\cdot}64 - (350{,}000 &= K \times 80{,}000) \times 0{\cdot}01 = 0 \\ 3{,}500 &- K \times 800 = 1{,}320 \\ 800K &= 3{,}500 - 1{,}320 = 2{,}180 \\ K &= \frac{2{,}180}{800} = 2{\cdot}725 \end{aligned}$$

which, of course, is an absurdity, as this would mean that when the diesel railway locomotive is putting in 500 hr. of work a month (U_d was assumed to be 500), the steam locomotive would not be able to give more than $500/2{\cdot}725 = 184$ hr. of work a month. The steam locomotive has been doing better than that for years.

Thus, so far, a real case of a diesel railway locomotive proving economical has not been found. Maybe the first cost of the diesel locomotive has been assumed at too high a figure. It must now be found what price a diesel locomotive should be, all other conditions remaining constant, in order to make it financially economical. Formula (3) is again used, applied to the New England conditions:—

$$\begin{aligned} e = 500 \times 2{\cdot}64 - (P_d &- 1{\cdot}25 \times 80{,}000) \times 0{\cdot}01 = 0 \\ 1{,}320 &= (P_d - 100{,}000) \times 0{\cdot}01 \\ P_d - 100{,}000 &= 132{,}000 \\ P_d &= 232{,}000 \end{aligned}$$

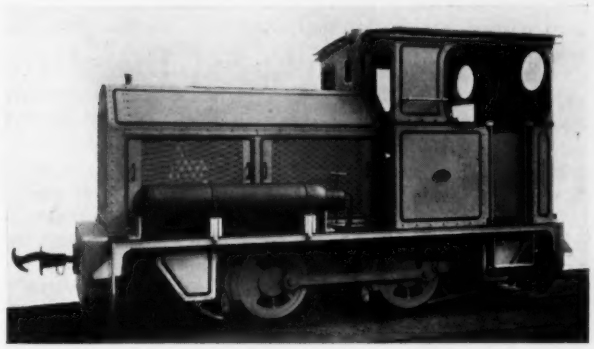
In other words, only when a 4,000 b.h.p. diesel locomotive can be built and sold for $232,000 will it become for some railway service at par with a steam locomotive of 3,200 i.h.p. in New England, and those parts of the U.S.A. where $C_s - C_d = 3 \times$ price of coal per short ton $- 200 \times$ price of diesel oil per U.S. gal. is more than $2·64.

FAST JAPANESE DIESELS—Some double-car streamlined diesel trains are being built for service over the Tokaido route of the Japanese Government Railways from Tokyo to Osaka and Kobe. Despite the 3-ft. 6-in. gauge, they will travel at a maximum of 75 m.p.h., and by their use the present time of nine hours will be reduced to six.

Small Diesel Locomotive for India

FOLLOWING the successful results of the 55 b.h.p. diesel-mechanical locomotive supplied last year by W. G. Bagnall Limited, and described in the issue of this supplement for May 18, 1934, the Assam Railways & Trading Co. Ltd. ordered another diesel locomotive of greater power from the same builder, and this has now been delivered.

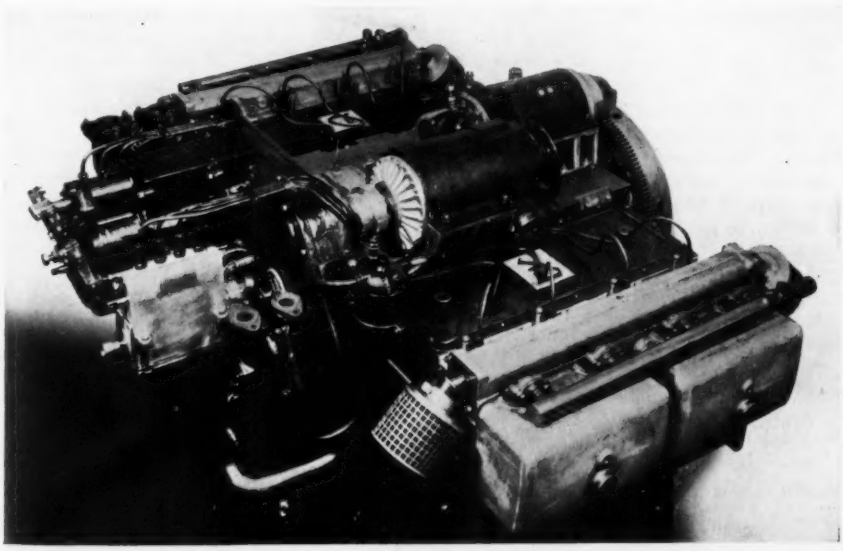
Built to the inspection of Messrs. Robert Bruce & Sons, Consulting Engineers, London, this new 14-ton locomotive is powered by a two-stroke Bagnall-Deutz diesel engine giving 77 b.h.p. at 300 r.p.m., the cylinder dimensions of which are $7\frac{7}{8}$ in. bore by $11\frac{3}{4}$ in. stroke. The cooling water is circulated by an engine-driven centrifugal pump through a radiator made by the Spiral Tube & Components Co. Ltd., and the engine is started by compressed air. At normal engine revs. the gearbox gives speeds of 3·25, 5·15, 8·15, and 13 m.p.h., the tractive effort on the first step being 6,400 lb. and on the top speed 1,150 lb. The 2 ft. $3\frac{1}{2}$ in. wheels are spread over a base of 4 ft. $7\frac{1}{8}$ in., the total length is 16 ft. 6 in., the height 9 ft. 2 in., and the width 7 ft. $2\frac{1}{2}$ in. Access to the engine is readily gained through large doors in the side of the bonnet, and in order to prevent all chance of sand getting into the working parts, the sandboxes are located well away from the engine, and are arranged so that they can be filled from rail level.



Latest diesel locomotive of the Assam Railways and Trading Company

A New Horizontal Engine for Railcars

A NEW type of horizontal light-weight diesel engine suitable for railcar applications has been designed and built by the Deutsche-Werke Kiel, and is now being installed in some vehicles of the German State Railway by the Triebwagenbau A.G., of Berlin. In these Reichsbahn cars (four-wheelers) the engine is mounted on a subframe below the car floor along with a four-speed T.A.G. mechanical transmission. The four-stroke engine has an output of 180 b.h.p. at 1,500 r.p.m., and the eight cylinders are arranged in two banks of four. Apart from the horizontal disposition of the cylinders, the main feature of the engine is the incorporation in the combustion chamber of the Lanova air cell. (See issue of this Supplement for June 16, 1933.) The cylinder blocks are of cast iron, and the heads are cast in pairs. The pistons are of light metal, and the five bearings of the four-throw crankshaft are lined with lead-bronze. Fuel is fed to the cylinders through two four-ram Bosch pumps mounted on one end of the engine frame, and the time of injection is varied automatically with the rotational speed. A Bosch electric starting motor is mounted on top of the crankcase, and the one inlet and one exhaust valve in each cylinder head are controlled by one camshaft for each cylinder bank. This engine, without starting motor or dynamo for the car lighting, weighs 2,720 lb., equivalent to 15·1 lb. per b.h.p. Over a 100 hr. continuous test conducted by the Reichsbahn, with the load varying only between full and three-quarters, the fuel consumption was 200 gr. per b.h.p. hr. (0·44 lb.). The standard railcar unit includes a 24-volt 1·2 kW. lighting dynamo, and a second machine can also be arranged if required. Each cylinder bank has its own air filter.



New horizontal engine of 180 *b.h.p. built by the Deutsche-Werke, Kiel, and now being installed in railcars for the German State Railway*

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The High-Speed Diesel from the Fuel Point of View

*By H. R. RICARDO, F.R.S.**

IN the high-speed diesel field the relation of the fuel to the engine is much less intimate than it is in petrol engines. In the case of the spark-ignited petrol engine, not only the specific power output available, but even the whole general design of the engine, depends almost entirely on the octane number of the fuel; so much so, in fact, that an engine designed to make the best use of 100 octane petrol will develop just double the power output of one designed for 70 octane petrol. No comparable relation exists or is ever likely to exist between the fuel and the engine performance in the case of compression-ignition engines.

Compression Ratios

In the case of the petrol engine, we are working normally with a relatively low ratio of compression and, therefore, on the steep part of the air cycle efficiency curve. Any increase in octane number allows us to work further up the efficiency curve, and it allows us also to increase the amount of supercharge. In the case of the compression-ignition engine, our ratio of compression is already such that we are working on a nearly flat portion of the curve and our efficiency is virtually unaltered over a wide range, while, as to supercharging, since we are unlimited by the incidence of detonation, we can supercharge as much as we like and to an equal extent, with any fuel. Our limit in this case is determined solely by the maximum cylinder pressure we are prepared to tolerate and is independent of the fuel we use. In other words, if it will run at all, a compression-ignition engine will give substantially the same power output and efficiency on any fuel which it can burn. It is in regard rather to secondary factors, such as silence, ease of starting, &c., that the nature of the fuel is likely to have any influence.

Combustion and Turbulence

In the petrol engine a ready prepared combustible mixture is ignited by the passage of a single spark which leaves behind a thin thread of flame; from this single minute nucleus inflammation extends, slowly at first, but with increasing rapidity until a stage has been reached when it can be spread, by turbulence, throughout the whole of the combustion chamber. Once the initial nucleus has been established, the subsequent rate of spread of flame is a function of turbulence and of turbulence alone. For this purpose the turbulence must be in the form of a general rough and tumble, in order to distribute the flame throughout the ready mixed combustible mixture. In the case of the compression-ignition engine, ignition takes place from the surface of a vast number of liquid droplets all travelling in definite directions, and the problem before us is to bring air to these droplets at at least as great a rate as it is being consumed by the burning fuel. To this end we require, not indiscriminate turbulence, but an orderly movement of the air across the stream of fuel. Mere turbulence as in the petrol engine is of little help to us, since what we must aim at is that as much as possible of the air within the cylinder shall pass across the stream of burning droplets and this can be attained best by setting the air within the combustion chamber into an unidirectional flow more or less at right angles to that of the fuel. In the petrol engine, combustion may be regarded as taking place in two stages—first, the building up of a self-propagating nucleus of flame, and second, the spread of that flame throughout the combustion chamber.

Combustion in the Oil Engine

In the compression ignition engine, the process may be divided into three stages:

Firstly, a delay period during which the surface of each individual droplet is surrounding itself with an envelope of vapour, the outer surface of which must attain such a temperature as to bring about self-ignition.

Secondly, a phase of very rapid burning while the many droplets which have accumulated during the delay period and which are surrounded by fresh and uncontaminated air all burst into flame in rapid succession.

Thirdly, a phase of controlled burning when, owing to the very high temperatures now ruling within the cylinder, the last series of droplets burst into flame almost as they enter the combustion chamber.

During this, the third phase, we have almost complete control over the rate of burning and therefore of the pressure, since these depend almost solely on the rate at which we choose to admit the fuel. I say "almost complete control" because in spite of all the intensive study which has been devoted to the design of injection equipment, we have not yet gained complete mechanical control of the rate of admission.

From the point of view of pressure control and of smoothness of running generally we want to speed up the first two phases and carry out as much of the combustion process as we can under the conditions of phase three. In many of the earlier high-speed diesel engines, phases one and two occupied so large a proportion of the whole process that phase three was elbowed almost entirely out of existence.

The Delay Period

The evils of prolonging the delay period are fairly obvious for, in the first place, the more unburnt fuel that accumulates during this phase, the more violent will be the rate of pressure rise during phase two, and the greater the diesel knock. Furthermore, if the fuel be a fairly volatile one but of relatively high self-ignition temperature, there is a danger of small pockets of vaporised combustible mixture being formed and of their being detonated just as in a petrol engine. If the delay period, therefore, be unduly prolonged, not only shall we have no proper control over the rate of pressure rise, which may be such as to cause a heavy knock, but with certain fuels or under certain conditions we shall get superimposed on this heavy diesel knock, a high pitch "ping" such as we are accustomed to hear in a petrol engine when detonating.

We can speed up the delay period in several ways:—

(1) By raising the ratio of compression.
(2) By adding heat to the air during compression.
(3) By reducing the size and increasing the dispersion of the droplets of fuel.
(4) By using a fuel of high cetene value or low self-ignition temperature.

With regard to the first, we are limited as to the compression ratio we can usefully employ, for whatever the type or form of the combustion chamber we use, there must inevitably be some air left outside in the cavity provided for the valves or in the clearance space between the piston and cylinder necessitated by purely mechanical

* In the Melchett Lecture read before the Institute of Fuel, October 9.

conditions. This air left outside the combustion chamber in thin and inaccessible layers cannot be reached by the fuel nor, even if it were reached, would it be hot enough for rapid combustion. It is fairly evident that in any given size of engine, the quantity of outlying air is constant and that as the ratio of compression is raised, so the capacity of the effective combustion chamber is reduced, and the proportion of outlying air increases, hence the maximum power output, which is purely a function of the amount of air we can burn, therefore diminishes as the compression ratio is raised. A small proportion of outlying air is always desirable, for it serves to consume completely any half-suffocated droplets which have entered the combustion chamber after most of the oxygen has already been consumed by the earlier arrivals. This process occurs in time to clean up the exhaust, but not in time to give any useful addition to the power output. It follows, therefore, that if we raise the ratio of compression beyond a certain point and still work to a given maximum pressure, we gain nothing in thermal efficiency and lose appreciably in power output.

Heating the Combustion Air

By fitting heat-insulated members in the combustion chamber which act as regenerators, we can add heat to the air during compression, but here again we are limited to a certain extent in that all the heat received and stored by such insulated members is taken from that of combustion—on full load we have plenty and to spare, but on light loads or when running idle, we are hard put to it to find enough. By such means we can make the delay period almost as short as we like on full load, but under prolonged running on light loads it is liable to lengthen out again. None the less, I am fairly satisfied that this is the best and most practical way of curtailing the delay, all the more so since the temperature of the heat-insulated members tends to rise rapidly with increase of speed; it can thus be made automatically to keep the proportional delay constant and therefore allow of fixed injection timing being used over the whole range of speed.

By reducing the size and increasing the dispersion of the droplets, we can reduce the delay period, but in practice we are very limited in this direction, for reduction of size involves reduction of penetration and, in most types of combustion chamber we need nearly all the penetration we can get, more especially if we are using a high compression ratio. By employing a fuel of what Boerlage and Broeze term a high centene number—that is to say, a fuel whose self-ignition temperature is relatively low—we can, of course, reduce the delay by increasing the differential between the air temperature and the self-ignition temperature of the fuel.

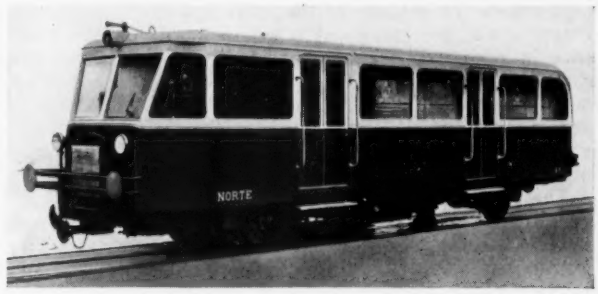
Some Delay Period is Necessary

I have said earlier on that we want to reduce the delay period as much as possible, but this remark needs qualifying, for, like everything else, we can overdo it. Imagine for a moment what would happen if there were no delay period at all. The fuel would burn immediately as it entered from the injector and the whole process of combustion would be concentrated round the nozzle of the injector; under such extreme circumstance, what chance would the rest of the air have of finding the fuel? We should get beautifully smooth running with perfect control, but very little power. We need, in fact, a delay period of sufficient duration to allow of fuel penetrating well into the chamber before combustion starts.

With regard to fuels in general, we can say that, in the majority of systems, a moderately high, but not too high, cetene value is advantageous, in that it serves to shorten the delay period and thus allows of a better control over the rate of burning and of pressure rise. As in the case of petrol, the cetene value of various fuels depends mainly on their source of origin but it can be varied somewhat by varying the distillation range or by doping with such substances as amyl nitrite, ethyl nitrate or certain peroxides. Generally speaking, any source which yields a bad, that is a low, octane petrol, will yield a high cetene diesel oil, and *vice versa*. As to volatility in general, within limits the lower the volatility the better, since too volatile a fuel is liable both to cause detonation and to give rise to gassing troubles in the fuel injection system. At the other end of the scale, if the volatility be too low, a further delay period will be introduced, due to the greater time taken to form a gas envelope on the outside surface of the droplets, as has been pointed out by Boerlage and Broeze.

Spanish News

Following some months of satisfactory performance on the Madrid-Segovia and other lines by the 14 diesel railcars of four different types described in the issue of this Supplement of February 22, 1935, the Norte Railway has ordered two four-car first and second class diesel-electric trains with buffet and restaurant, which are to be built on the lines of the Flying Hamburger but with a total engine output of 1,500 b.h.p. They are to be used



90 b.h.p. Beardmore-engined railbus on the Spanish Northern Railway

on the run from Madrid to the French frontier at Hendaye, and it is hoped that they will enable the present fastest schedule of 12 hr. to be reduced by something like four hours, with an average of about 45 m.p.h. and a maximum of 70 m.p.h. Two further four-car trains with second and third class accommodation, and generally less luxurious than the units described above, have been ordered for express service on the Madrid-Vigo and Madrid-Gijon routes. The present steam schedule from the Spanish capital to Vigo is about 17 hr., and it is expected that the diesel trains will be able to knock three or four hours off this timing. The Beardmore-Somua car shown above (see also February 22 issue) has a Vulcan-Sinclair fluid coupling and a Clarkson waste-heat exhaust gas heating boiler. The top speed is 64 m.p.h.

On the Madrid Saragossa & Alicante Railway the four 410 b.h.p. Maybach-engined cars, described in the issue of this Supplement for February 22, are in operation with driving trailers on the Madrid-Aranjuez-Cuenca line, and the car with a Burmeister & Wain engine is at work also. The Central of Aragon Railway is using two 150 b.h.p. cars with Deutz engines and Mylius transmission.

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Critical Speeds and the Railway Diesel Engine*

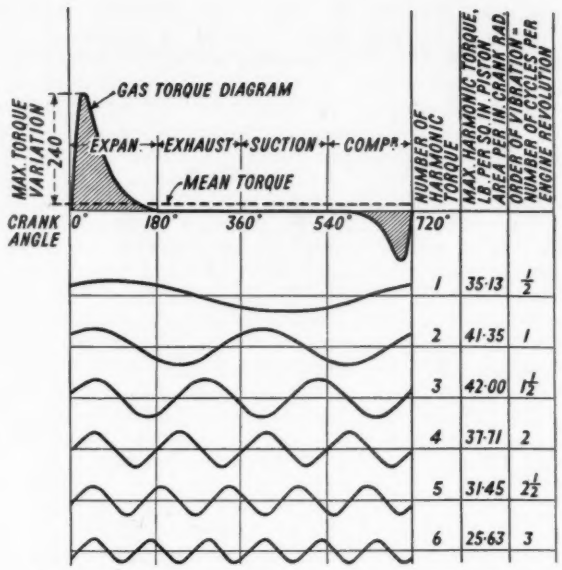
THE problem of critical speeds is a fundamental one with the high-speed engines now coming into extended use for railway purposes. Criticals which previously were above the running range may be brought within it, and require the application of a torsional vibration damper.

In switching service the diesel engine may accelerate and decelerate many times in a minute. Each acceleration from idling to full speed may take place in two to three seconds, representing an angular acceleration of 20 radians per sec. per sec., compared to accelerations of one hundred times this amount which may be experienced in the engine at a critical speed without damping. Crankshafts and auxiliary drives must be designed to withstand this type of loading, resulting in the necessity for ample stress factors to withstand the normal accelerations due to changes in the engine speed.

The importance of the problem of torsional vibration may justify giving a few of the elementary factors involved, especially as this type of work is usually assigned to the specialist. The crankshaft, flywheel, and generator armature with the piston and connecting-rod masses concentrated at their crankpin centres have a tendency, when twisted, to vibrate naturally; that is, the crankshaft will twist one way and the generator shaft the other from a point, termed the node, located between the engine and generator. The frequency of this natural vibration depends on the stiffness of the shaft and the location and magnitude of the masses attached to it. If the gas pressure in each cylinder were a steadily applied force the shaft would simply twist and then revolve in this twisted condition. The forces acting on the crankpin, however, are variable and cyclical. Therefore the shaft may vibrate naturally with a motion superimposed on the rotary motion.

The gas pressure in the cylinder at each point on the cycle can be found from the indicator card, and from these pressures a torque diagram can be drawn. This torque curve is the resultant of individual forces, and by means of a Fourier analysis of it a true representation of these individual forces can be determined. The reconstructed torque diagram will consist of a number of individual waves, one repeating itself every two revolutions, another three times, another four times. and so on, so that when the forces of each wave with their positive and negative values are summed up at any point, the resultant will be identical with the torque recorded by the torque diagram at that point.

At the crankpin, therefore, there exists a number of regularly repeated forces, any one of which will set up a critical vibration at that rotational speed, if the number of waves it makes per revolution multiplied by the engine speed in revolutions per minute gives a result which coincides with the natural frequency of the shafting. In an engine speed range there may be as many as ten critical speeds, yet only two may be noticeable. Any one of these critical speeds, however, would give rise to vibrations that would break the crankshaft if inherent damping did not exist in the system. When the shaft is stressed there is a hysteresis loss in the metal which the calculator must estimate in determining the amplitude that will be obtained at each critical speed. If the calculated stresses, including concentration factors for oil holes in the shaft, are of such magnitude as to jeopardise the shaft, or if the amplitudes are high at points in the shafting from which gears for the auxiliaries are driven, then external damping in the form of a torsional-vibration damper should be applied.



Gas torque diagram and the first six harmonics of which it is composed

In regard to the location of auxiliary drives, in engine designs generally these are at the end of the crankshaft where the amplitude is a maximum, whereas the ideal position is between the engine and generator at the nodal point where the amplitudes are negligible. This is where the flywheel is usually placed, its value thus being negligible except as a means of barring the engine over. The torsional-vibration damper should be located at the end of the crankshaft where the amplitude is greatest. The damper consists of two flywheels driven by a spring-borne friction clutch. The spring pressure and coefficient of friction have to be so proportioned relative to the mass of the flywheel rims that when the crankshaft vibrates the flywheels will not vibrate with the shaft, permitting energy to be absorbed in friction between the shaft and the damper rims. Marked differences may exist in the functioning of a damper of this type because of differences in the coefficient of static and running friction in the clutch material used. Scoring of the flywheel rims may weaken its effectiveness if the unit pressures are too high and the material of the rims is not properly chosen. At one time this type of damper was considered of little value, due, no doubt, to lack of knowledge of what was required of it. Torsiograph records have proved its initial effectiveness and field service has shown its ability to perform in keeping with other parts of the engine.

The vibration damper has the advantage that it reduces the maximum amplitude and stress but has the disadvantage that it spreads the reduced amplitude over a much wider speed range, giving to the crankshaft practically a continuous oscillating motion which can act very unfavourably on auxiliary drives, necessitating in many cases spring flexibility to reduce tooth loading. The four-cylinder in-line engine does not present as severe a problem of critical speeds as the 6- or 12-V; and the 8-V is preferable to the straight eight. It seems desirable to couple the generator and crankshaft rigidly, as this makes possible the definite determination of the critical speeds in advance, a condition that cannot always be met where a flexible coupling is employed.

* From a paper read before the American Society of Mechanical Engineers by Mr. John Dickson.

High-Power Railcars for Long-Distance Suburban Work

New application in Denmark

AS announced in the *Diesel Railway Traction Supplement* of June 15, 1934, the Danish State Railways in 1934 ordered ten diesel-electric railcars from A/S Frichs. Later it was decided to order two railcars of the same power and size from Burmeister & Wain. These 12 cars have now been delivered and went into service on October 6, with the inauguration of the winter timetable.

These new cars have two bogies, one three-axle and one two-axle, and both of them have a wheelbase of 3·2 m. (10·5 ft.). All axles have S.K.F. roller bearings. The car contains an engine room, two passenger saloons seating 52 passengers, and a luggage room. The seats are upholstered in leather and head rests are provided. The windows are of the same type as used in the articulated Lyntog, with the lower part fixed and the upper part dropping outside the lower part. The car has a hot water plant, and compressed air brakes are provided. All the bodies have been delivered by the Scandia Works, of Randers.

The 10 cars with Frichs engines have each two four-stroke diesel engines of 250/275 b.h.p. each, running at 1,000 r.p.m. and driving directly two d.c. generators of 165 kW. The maximum speed is 120 km.p.h. (75 m.p.h.), but the transmission and the electric motors have been so constructed that the car has a considerable tractive power even at a speed as high as 80-90 km.p.h. (50-56 m.p.h.). The electric motors and generators have been supplied by Titan Limited, of Copenhagen.

The regulation of the engine speed and of the electrical transmission is done automatically in the same way as in the Lyntog, except that over the higher speed range a further automatic regulation of the voltage is obtained by a so-called centrifugal contact, driven from one of the axles. The contact opens and closes corresponding to the speed and thereby controls the voltage. The automatic system as well as some of the electrical apparatus has been supplied by the Swedish firm Asea, of Vasteras. The two cars with Burmeister & Wain engines have each two two-stroke six-cylinder 250/275 b.h.p. engines of a new type running at 1,200 r.p.m. These cars are in all other respects similar to those with Frichs engines and have the same system of automatic control, but the electrical equipment has been supplied by Th. B. Thrige, of Odense.

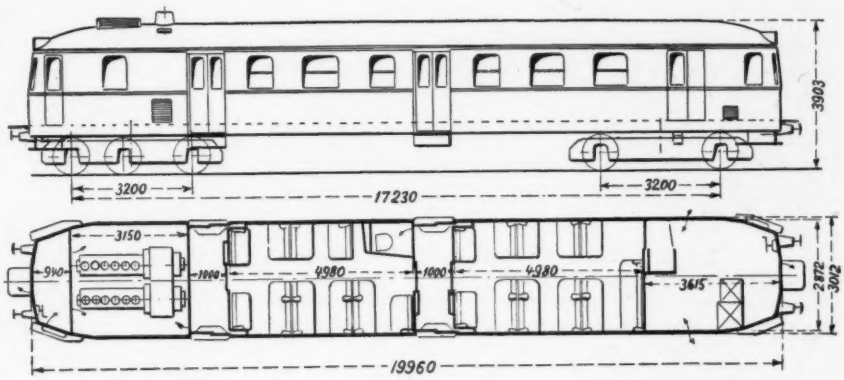
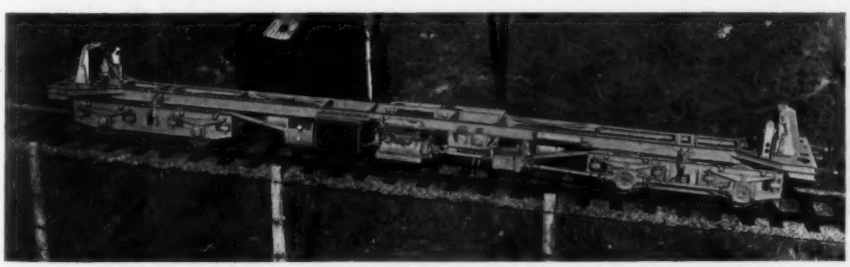


Diagram of new 500 b.h.p. diesel-electric railcars for train haulage round Copenhagen, Danish State Railways

On test runs it was found that each car was able to pull three trailers of the Danish State Railways' standard suburban type (a bogie saloon car seating 77 passengers and weighing 34 tonnes tare). Further, two diesel cars can be coupled together, and in this case they are able to pull five trailers. Although the five trailers are placed between the two diesel cars it is possible with a system of remote control to operate both of them from one of the driving positions.

The new diesel cars are being used mostly on suburban services providing a more or less exact hourly service in both directions between Rungsted (to the north of Copenhagen) through the capital to Roskilde (to the west of the city) and return. In all, 21 services are given in each direction. The total distance from Rungsted to Roskilde is 56·4 km. (35·6 miles) and the running time including stops is 75 min. with a train of 80 tons and 83 min. with a train of 120 tons behind the car. These cars are used also for a few stopping services on other routes and for one or two express services, and are booked to cover 114,000 km. (71,000 miles) each in the year, including those kept as reserve.



G.W.R. Cars

The chassis of one of the new Great Western Railway double-engine 260 b.h.p. railcars outside the works of the builders, the Hardy motors division of the A.E.C.

XUM

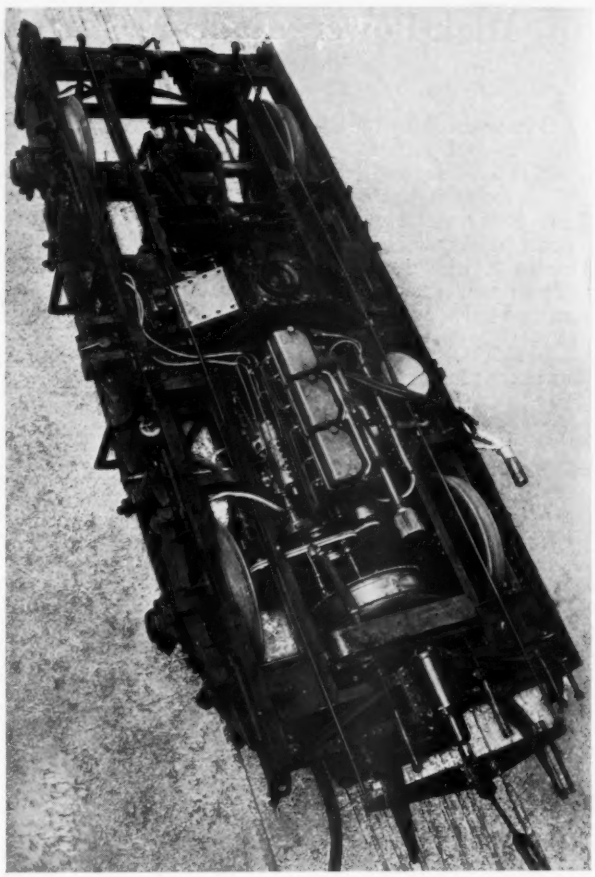
DIESEL TRACTION WITH LIGHT CARS IN WESTPHALIA

New double-bogie double-engine design incorporates well-tried Mylius transmission

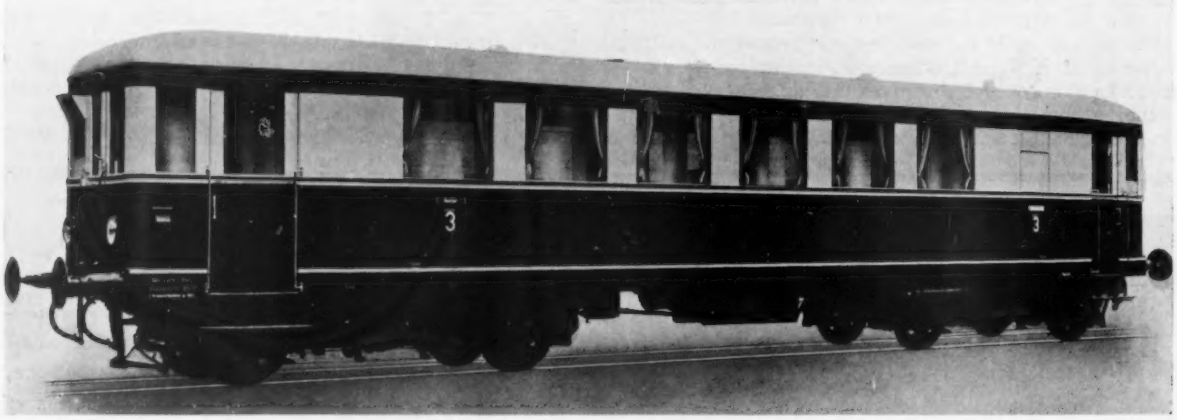
A LIGHT double-bogie car with two 95 b.h.p. Mercedes-Benz engines and corresponding sets of Mylius four-speed mechanical transmission has been built by the Waggon-und Maschinenbau A.G., of Görlitz, for passenger service on the standard-gauge Westfälische Landes-Eisenbahn in Germany. By welding and the use of a combination of steel and light-metal sections, the tare weight has been kept as low as 24 tonnes for a carrying capacity of 76 third class passengers, with lavatory and luggage accommodation. The car has an overall body length of 15·56 m. (51 ft. 2 in.), and runs on bogies with a wheelbase of 3·2 m. (10 ft. 5 in.) pitched at 9·6 m. (31 ft. 6 in.) centres.

Each bogie runs on four Jaeger roller-bearing axleboxes and carries a complete 95 b.h.p. power and transmission plant, and the overall dimensions of the engine and gearbox are small enough to allow of these constituents being entirely below the floor level of the car. Each set of Mylius gear drives the outer axle of the bogie on which it is mounted, and at the normal engine speed gives road speeds of 15, 24, 44 and 70 km.p.h. (9·5, 15·0, 27·5 and 43·5 m.p.h.). As may be seen from one of the accompanying illustrations, the radiator is mounted on the inner end of the bogie and the fan is driven directly by the engine. In cold weather the engine cooling water is circulated through heaters placed beneath the seats in the passenger saloon. The Mylius gearbox is of very small size and can be accommodated without trouble on the bogie frame structure. The sandboxes, Kunze-Knorr air-brake cylinders, air-brake reservoirs and other details are mounted on the bogies.

Electric lighting equipment is installed throughout the car and the current is supplied from two batteries each of 150 amp.hr. capacity, which are charged by two 500-watt 24-volt generator sets; these generator sets also supply current to the Bosch starting motor attached to each engine. A simple form of air filtering and forced circulation by three motor-driven fans has been installed in the passenger saloons. A driving position is arranged at each end of the car, and one or both engines and gearboxes can be controlled by mechanical-pneumatic means. Trailers can be hauled in normal service.

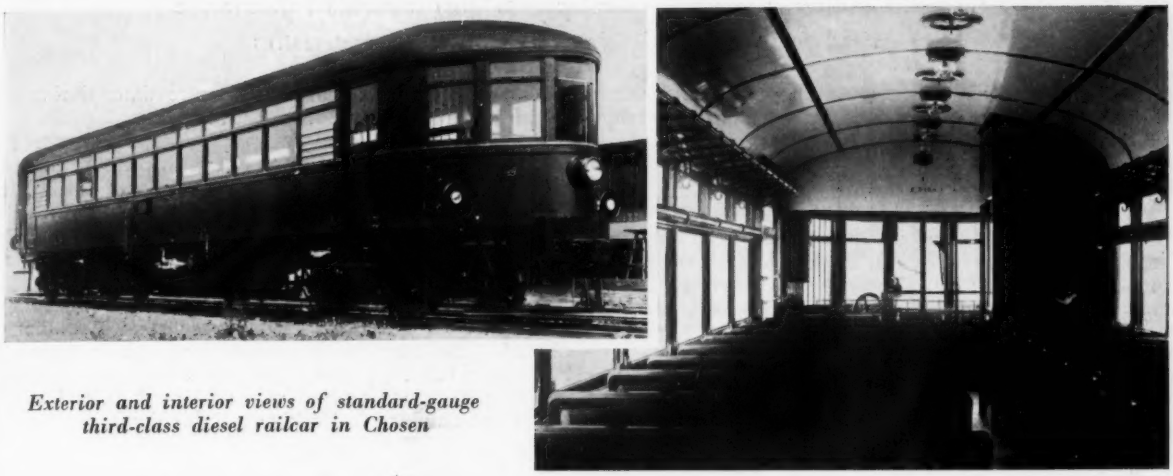


Aerial view of bogie and transmission



New light passenger double-bogie car, Westphalian Provincial Railway

LIGHT DIESEL RAILCARS IN THE FAR EAST



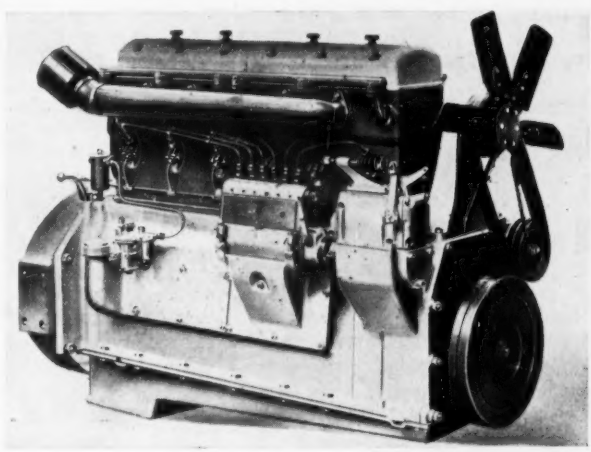
Exterior and interior views of standard-gauge third-class diesel railcar in Chosen

TWO years ago the Chosen Government Railways placed in service two diesel-mechanical railcars on its standard gauge lines. These cars are used on light passenger work, and were constructed in the railway's own shops at Keijo. Third class accommodation only is provided, the seating capacity being 89.

Motive power is afforded by a M.W.M.-Benz diesel engine, developing 110 b.h.p. at 1,300 r.p.m. in six cylinders, 125 mm. by 170 mm. (4·92 in. by 6·7 in.). The maximum output is 130 b.h.p. The old Benz precombustion chamber has been developed into an air cell in the cylinder head. The crankcase is of light metal, and the engine weight is 2,860 lb. including flywheel.

The transmission is mechanical through a four-speed Cotta gearbox attached directly to the engine. The engine-transmission unit is slung beneath the underframe and drives one pair of wheels through a cardan shaft. The gear steps are 4·75 to 1; 4·0 to 1; 2·0 to 1; and 1·0 to 1. Electric starting is provided and this is operated from a 30-volt Bosch generator which also supplies the lighting current.

As shown in the diagram below, the cars have a driving compartment at each end. They are capable of a maximum speed of 75 km.p.h. (46·6 m.p.h.) and tare approximately 26 metric tons. The four-wheel bogies have axles fitted with S.K.F. roller bearings. Two doors are set on each side of the vehicle, and heating is on a combined exhaust gas and hot water system. Light luggage racks are arranged above the windows, and the electric lights are placed centrally down the carriage ceiling. The overall length of these vehicles is 64 ft. 11¾ in.



110/130 *b.h.p. MWM-Benz diesel engine*

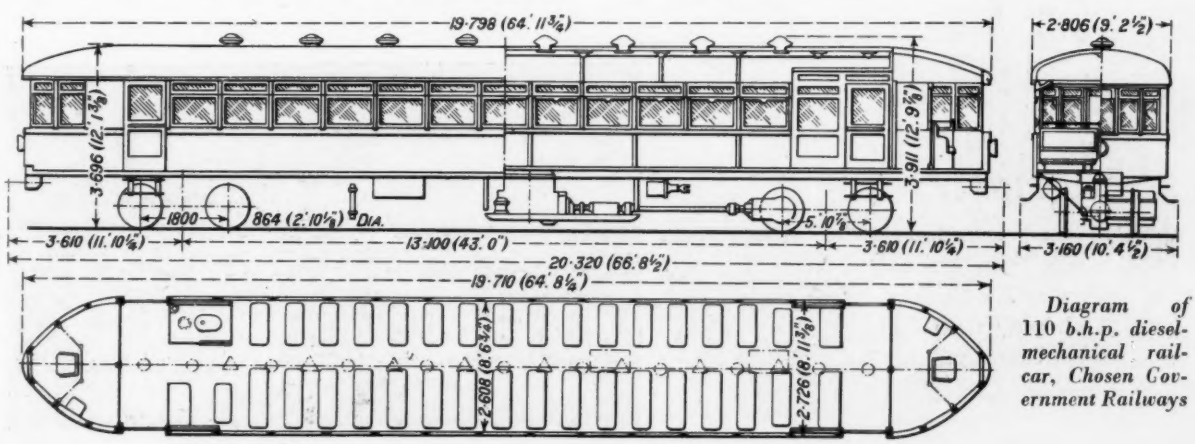


Diagram of 110 b.h.p. diesel-mechanical railcar, Chosen Government Railways

XUM

THE TESTING OF DIESEL ENGINES

A special indicator has been developed to give accurate information required for the investigation of the fuel characteristics

THE essential characteristics of a good fuel for the railway type of oil engine may be grouped generally under the three following headings:—

(1) Suitable physical characteristics.
(2) Correct ignition quality.
(3) Freedom from contamination.

Of these three, ignition quality is the most elusive and difficult to determine. Physical qualities can be examined in the laboratory and contamination is avoided by careful filtering and handling at every stage of the oil's journey from the refinery to the cylinder of the engine. Ignition quality, however, cannot be determined by any known laboratory test, but can only be satisfactorily examined by taking careful records of the behaviour of the fuel in the engine itself.

With the present types of diesel engine it is desirable to use only those fuels which start to burn quickly, for two important reasons, viz.,

(1) The delay period between injection and ignition is reduced, thereby eliminating combustion shock due to the uncontrolled burning of the excess amount of fuel entering the cylinder prior to ignition.
(2) Ease in starting under varying climatic conditions is obtained.

Recognition of the importance of obtaining fuels which have a short delay time between injection and the beginning of rapid burning has meant that special methods of fuel testing have had to be developed, so that phenomena occurring in times as short as one ten-thousandth of a second can be accurately observed. It is necessary, for example, to be able to determine precisely when the spray valve opens and to know whether it remains open or vibrates against its seating; the duration of opening must be determined, and also, in some cases, the nature of the pressures in the fuel supply pipes. The difficulty of the problem may be realised when it is mentioned that an atomiser may be lifted only eight to ten thousandths of an inch, the full lift taking less than a thousandth of a second and that, in addition, the valve may partly or entirely reseat two, three or even more times during the next five- or six-thousandths of a second.

Pressure waves in the fuel supply pipe between the fuel pump and the atomiser may lead to pressure fluctuations at the atomiser end of the pipe, of about a 1,000 lb. per sq. in. in times as short as those associated with the atomiser valve movements themselves; pressures in the engine cylinder may rise by 200-300 lb. per sq. in. in almost equally short intervals. No mechanical indicator can give more than a very imperfect record of the changes which take place and it is for this reason that the Sunbury Electrical Indicator has been developed. As recorded in the issue of this Supplement for September 6, this indicator was exhibited on the stand of Shell-Mex & B.P. Limited at the last Shipping & Machinery Exhibition.

How the Indicator Functions

A special design of engine built for fuel testing purposes is shown in Fig. 1. It is fitted with means for accurate control of all operating conditions and can be used either for measuring ease of starting or for working tests under load. The compression ratio is adjustable to simulate different engine designs or to meet special experimental requirements. Many of the important mechanical details were developed by the Delft Laboratory of the Royal Dutch Shell Company.

An illustration of the indicating apparatus is given in Fig. 2. One of the essentials of the indicator is a cathode ray tube of the type developed for television purposes. Such a tube has the faculty of responding instantaneously to any electrical impulse applied to it and, unlike any mechanical device, is entirely free from inertia effects which may introduce vibrations to mask effects actually taking place in an engine to which it may be applied.

When this cathode ray tube is in use, a brilliant spot of light appears on a fluorescent screen at the larger end and this spot is deflected by any voltages or magnetic

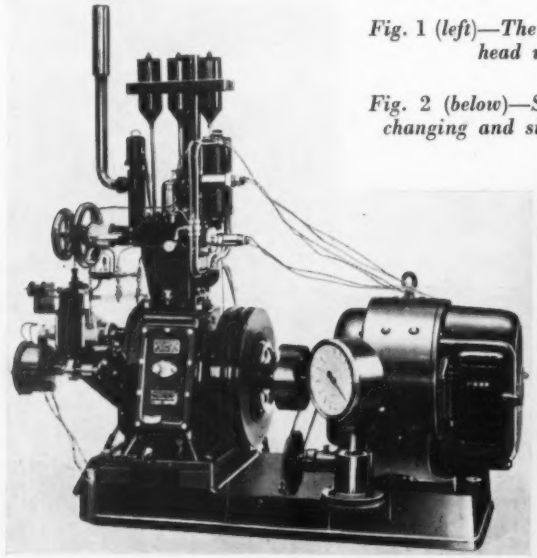
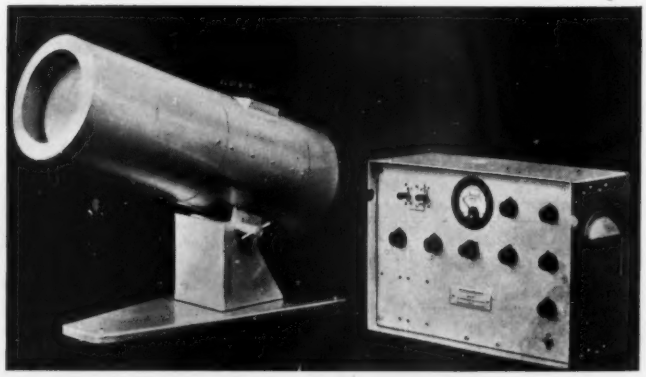


Fig. 1 (left)—The Co-operative Fuel Research diesel engine with variable-compression head which is used for the testing of different types of fuel

Fig. 2 (below)—Sunbury electrical indicator which gives indications of pressure-changing and similar phenomena occurring in a time as short as 0·0001 sec.



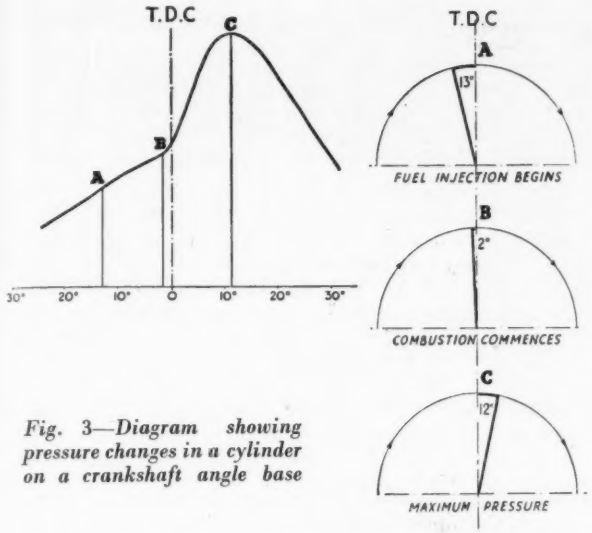


Fig. 3—Diagram showing pressure changes in a cylinder on a crankshaft angle base

forces applied to what are known as the deflecting plates of the tube. It is a comparatively simple matter to arrange a contact breaker driven from the engine crankshaft so that the spot of light travels across the screen along a horizontal line and so that it has always reached exactly the same place for any given position of the engine shaft. A ripple may be superimposed on this line which marks degrees of crank angle and also shows the top dead centre or any other reference position. For normal fuel testing purposes the rate of movement of the indicating spot is such that it travels about one tenth of an inch in a six-thousandth of a second, although either slower or faster rates are easily obtained with a simple control.

If a voltage is applied to a second pair of deflecting plates in the tube, the light will move vertically instead of horizontally and, if this separate voltage is one which varies with, say, engine cylinder pressures, the vertical travel will be proportional to the pressures. By applying both voltages at the same time, a diagram is produced which gives the change of pressure in the cylinder on a crankshaft degree base. Such a diagram is shown in Fig. 3.

Obtaining Cylinder-pressure Changes

Considering now the method of obtaining cylinder-pressure changes, many alternatives are available, but in all cases, there must be at least one mechanical member. Provided this is very stiff and is only required to move a very small distance compared with anything used in conjunction with a mechanical indicator, its high natural frequency is so far above the frequencies at which phenomena associated with engine and fuel behaviour occur, that the limitations due to its mechanical nature are entirely negligible.

In the Sunbury indicator a small and thick diaphragm is used, mounted in a stout fitting screwed into the engine cylinder. This diaphragm has a natural frequency of about 40,000 cycles per sec., and, even at the highest cylinder pressures, has only to move about one two-thousandth of an inch. Its inertia effects are thus negligible and it is practically unaffected as regards behaviour by the temperatures reached in normal working. Its movements follow the pressure changes in the cylinder with such rapidity that its rate of movement at any instant is almost exactly the rate of change of pressure in the cylinder. Mounted near to this iron diaphragm, but at an appreciable distance from it in comparison with the maximum deflection, is a small electro-magnet around the pole of which is wound a few thousand turns of fine wire. Voltages are induced in this coil when the engine is running, which are very closely proportional to the rates of pressure change in the engine cylinder. These voltages are amplified in a special amplifier comparable in construction with a simple wireless receiver and applied to the cathode ray tube.

A unit similar in general principle is used in the fuel supply pipe to register fuel pressures and a diagram from this indicator is shown in Fig. 4. The fuel pressure starts to rise at A when the fuel pump plunger over-runs the pump suction port and the rising pressure is checked at B by the opening of the spray valve. Following this is a series of pressure waves, the frequency of which is determined by the length of the fuel pipe, the atomiser valve closing at C soon after the pump delivery valve

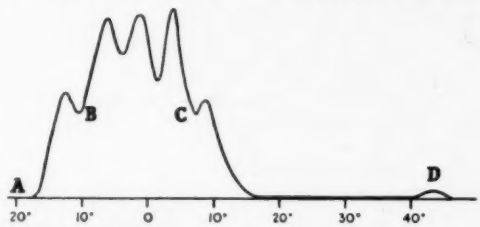


Fig. 4—Diagram showing pressure changes in fuel pipe between pump and atomiser

closes. In the design of pump used on the engine on which these tests were made, there is a period during which a partial vacuum is created in the pump barrel. When this barrel is opened to the suction pipe the rush of fuel to fill the vacuum gives a blow to the delivery valve which lifts slightly and sends a pressure wave as shown at D through the fuel pipe to the spray valve. Normally, this will not reopen although it may do so in certain circumstances, producing a later and almost wasted injection of fuel.

American Activities

The Chicago Burlington & Quincey has just put into service a fourth Zephyr streamlined train. This unit, named *Mark Twain,* is now making one or two exhibition trips, but at the end of this month will go into regular operation between Burlington and St. Louis, stopping en route at Hannibal, the birthplace of S. L. Clemens (Mark Twain).

The New York, New Haven & Hartford Railroad is considering the purchase of two more streamlined trains, but with five or six cars in place of the three of the 800 b.h.p. Comet, which is now running between Boston and Portland. If a purchase is decided upon, it is possible that the new trains will run between New York and Boston, passing for 60 miles over the New York to New Haven electrified section.

The Baltimore & Ohio is the latest American convert to diesel propulsion. In addition to an 1,800 b.h.p. double-bogie diesel-electric locomotive which is being tried on certain expresses (but not The Royal Blue Limited, as reported in certain papers), a three-car train rebuilt from passenger cars which were lying idle has been put into service between Washington and Baltimore. Two 300 b.h.p. Fairbanks-Morse opposed-piston engines are installed in one end of the train. The 1,800 b.h.p. locomotive is identical with one half of the A.T.S.F. Railroad's 3,600 b.h.p. locomotive described in the October 4 issue of this Supplement.

XUM

NOTES AND NEWS

Railcars for Greece.—The Hellenic State Railways have ordered some diesel railcars for their standard-gauge lines, and these are now being built in Austria.

More Danish Railcars.—The Danish State Railways have ordered from Frichs 10 more 500-b.h.p. double-bogie railcars of the type put into service round Copenhagen, and described elsewhere in this issue.

More American Diesels.—The Seaboard Air Line has ordered from the Electro-Motive Company two single streamlined railcars with 600 b.h.p. Winton two-stroke engines for passenger and mail service.

Russian Rumours.—Soviet whispers have it that a works capable of producing 500 steam and 500 diesel locomotives is almost completed at Orsk. At the moment, Kolomna works is the only U.S.S.R. establishment definitely capable of building diesel locomotives.

Hire Purchase for Diesels.—Mr. F. C. Nissen, late Manager and Locomotive Superintendent of the Jamnagar & Dwarka Railway, India, recently sailed from this country for Bombay to form a syndicate to assist small Indian railways to purchase diesel locomotives and railcars on the hire-purchase system.

Fluid Flywheel Patents.—Mr. Harold Sinclair, of the Hydraulic Coupling & Engineering Co. Ltd., has instituted High Court proceedings against the Daimler Co. Ltd., of Coventry, challenging the validity of patents held by that organisation. Mr. Sinclair is well known for his development of the Vulcan-Sinclair fluid couplings as used on diesel locomotives and railcars.

Maybach Engines.—The Maybach Motorenbau A.G., of Friedrichshafen, and its licensees have now delivered 373 diesel engines for railcars and articulated trains in powers of 150 to 600 b.h.p. Some of these engines are held in reserve by administrations having a number of vehicles. Approximately 250 of these engines are mounted in vehicles belonging to the Reichsbahn or held in reserve by that organisation.

More German "Flyers."—The German State Railway has introduced another streamlined diesel train, the Fliegende Lindauer, on a fast schedule between Augsburg and Lindau, on the south shore of Lake Constance. This run does not come within the scheduled routes for the 13 double-car trains built this year, and it is probable that ere long it will be transferred to one of the specified routes. (See *Diesel Railway Traction Supplement* for February 22, 1935, page 364.) At the beginning of this month another double-car unit will begin a service between Cologne and Hamburg on an overall schedule of 65 m.p.h. in one direction and 68·2 in the other, including seven stops.

Leyland's for New Zealand.—In addition to the order for seven diesel engines and transmission sets for railcars ordered a short while ago from Leyland Motors Limited, the New Zealand Government Railways have ordered a further seven similar sets for installation in railcars to work over the Rimutaka incline, which has 1 in 14 grades. Special cooling arrangements are to be provided for the torque converter fluid and engine-cooling water to prevent overheating while traversing the mountain region.

Diesel Agitation in East Africa.—A great deal of discussion has been going on in Kenya about the advisability of introducing railcars to cope with the rapid decline in passenger traffic (principally in the third-class category) through the efforts of road transport concerns. Railcar services have been suggested for third class traffic between Mombasa and Nairobi, while still retaining steam trains for first and second class, where many of the passengers are going or returning from overseas and have a lot of baggage. Certain critics complain that the railways have condemned railcars out of hand, but the railway administration maintain that they have access to all the latest information in the world, and consider that the railcar is unsuitable for their line.

Lightweight 150 b.h.p. Berliet engine with attached main generator as used on small diesel railcars belonging to the P.L.M. Railway

Berliet Engines.—The diesel engines used on the latest railcars of the P.L.M. are of the Berliet type and are used with electric transmission in place of the more usual (in France) mechanical drive. The model utilised develops 150 b.h.p. at 1,500 r.p.m. in six cylinders 135 by 180 mm. (5·33 by 7·1 in.), and it is shown mounted on a special welded-steel subframe with direct-coupled main generator in the illustration on this page. A feature of the engine is the air-cell of the Acro type incorporated in the crown of the piston. All the bearings are of the plain type. The six cylinders are cast in one piece, and the barrels are fitted with liners in which run aluminium pistons. The cylinder block is mounted on an aluminium-alloy crankcase. Fuel is injected by Bosch pumps, and the inlet and exhaust valves are controlled by a gear-driven camshaft located in the upper part of the crankcase. The Berliet engine is used also in railcars belonging to the Eastern Railway of France and several French provincial railways, and in the railcars of the Congo-Ocean Railway described in the issue of this Supplement for September 7, 1934.

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